

Foundation Maths and Portfolio Assessment: An Irish Experience

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INTRODUCTION

The National Council for Vocational Awards (NCVA) was established in 1991 (NCVA, 1992) to set, monitor and certify standards for vocation, education and training programmes provided within the further education sector. NCVA awards are intended to provide access to employment, further education and further training. The Council through its awards and activities serves as an important facilitating agency in life long learning for Irish citizens. Its awards are adult focused and programmes leading to NCVA certification are conducted in a variety of settings including schools, workshops, community and adult education centres.

The NCVA has been innovative in its approach to assessment and certification. It has pioneered the use of portfolios of evidence for assessment purposes in a wide range of subjects in Ireland. The authors have been providing support services for the Foundation Level Mathematics for a number of years including the training of tutors. This paper focuses on the use of portfolio assessment in foundation level mathematics: the strategy for implementation on a national scale; learners' portfolios; problems and opportunities; and future directions.

DEVELOPMENTS IN FURTHER EDUCATION IN IRELAND

From the middle of the 1980's further education became an important sector on the Irish educational landscape. In an effort to address these ad hoc developments the Government Department of Education launched a number of initiatives. Two of the most noteworthy of these initiatives were the Youthreach Programme (1989) and the Vocational Training Opportunities Scheme (VTOS) (1989). The target group for the Youthreach programme was early school leavers between the age of 15 and 18 years, while the target group for the VTOS programme was long-term unemployed adults over the age of 25. It was obvious at the time that these programmes were reacting to a 'here and now' problem. What wasn't obvious was that these programmes were to provide one of the most effective long-term solution to the problem of 'formalising' the further education sector.

After the euphoria of having achieved recognition and a certain structure for this new sector of education, providers and practitioners came to realise that the provision of assessment and certification for the non-formal courses they were delivering needed to be addressed. Initially VTOS providers had taken upon themselves to deliver the formal department of education Leaving Certificate courses. These courses were assessed through formal State exams and certified by the Department of Education. However, it was obvious that established programmes of study culminating in a formal written examination would not address the needs of the vast majority of participants of Youthreach particularly, and VTOS to a lesser extent.

A NATIONAL STRATEGY

Initial consultative stage

The National Council for Vocational Awards was established in 1991 with the specific purpose of addressing the assessment and certification needs of learners taking vocational courses and programmes in Ireland (NCVA, 1992). The attention of this new organisation was immediately drawn to the issue of assessment and certification for the client groups in the emerging further education sector. Youthreach, VTOS, prison education, Travellers training, Post Leaving Cert., and community education were all part of the constituency which made up this further education sector. This was new territory for everyone involved and the NCVA wisely initiated a systematic consultative process in an effort to establish the assessment and certification needs of this sector of education. Concentration was directed towards addressing the needs of first step or basic level i.e. Foundation Level.

This consultative process produced many suggestions and some requirements. Among the requirements for the assessment approach to be used were:

- that it be continuous, comprising progressive short-term objectives
- that it be learner centred, where the learner is expected to become actively involved with recording achievements in the particular subject areas
- that the continuous generation of evidence of achievement be converted into a summative qualification
- that there be no sit-down summative exam.

Among the recommendations were:

- mastery of behavioural objectives be used rather than percentage achievement
- care needed to be taken so as not to 'atomise' the subject matter
- a cross curricular, integrated approach be encouraged.

NCVA stage structure for progression

There is a well defined national structure for certification at various stages and progression through these stages is defined. (See figure 1).

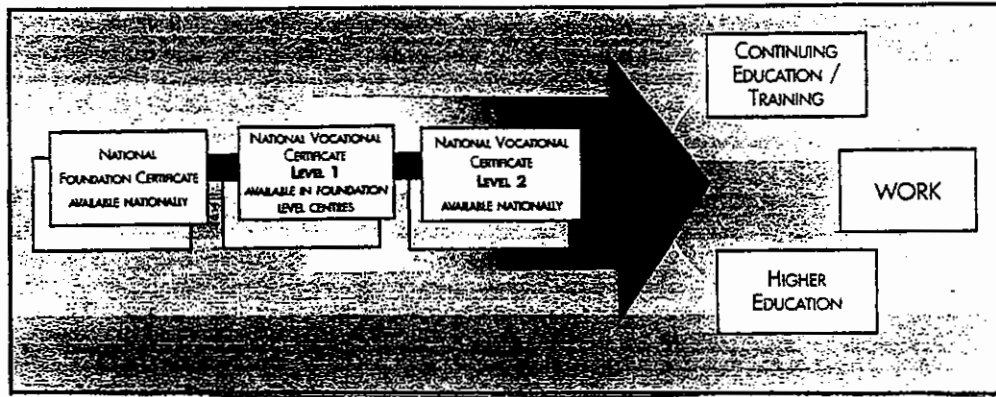


Figure 1. National framework of qualifications. (NCVA, 1998)

While the NCVA is determined to make this structure work in practice there are still many obstacles to be overcome especially as regards entry to higher education.

The NCVA perspective

It is useful to look at the process from the point of view of the NCVA. By focusing on the role of various actors in the process, it is possible to develop a more informed view. Four actors with specific roles are identified for further consideration:

- the NCVA
- the providers
- the tutors
- the learners.

The role of the NCVA

The role of NCVA is to set, monitor, and certify standards for vocation, education and training programmes. The setting of standards, for foundation level mathematics is achieved through the specific learning outcomes and the performance criteria laid down in the module descriptor. In-service seminars are provided by the NCVA to familiarise tutors of foundation level mathematics with the module descriptor and to give some directions on the evidence required for inclusion in the assessment portfolio. The monitoring of standards was initially achieved through a cross-moderation process. External examiners are now employed to fulfil this role. Certification completes the role of NCVA.

The role of the providers

Providers of foundation level mathematics must ensure that their tutors attend the in-service seminars provided by NCVA. It is also their responsibility to develop a curriculum which would not only accommodate the requirements of the foundation level module descriptor but would also be relevant and realistic for adult learners. All documentation regarding assessment and certification is the responsibility of the providers.

The role of the tutors

Tutors enable their learners to achieve the standards of mathematics competence laid down in the module descriptor. This calls for innovative and creative approaches to the teaching and assessing of mathematics. The construction of the Assessment Portfolio is a collaborative task between the tutors and the learners.

The role of the learners

Learners must generate evidence of achievement for all the learning outcomes in the module descriptor. NCVA believe that learners in the further education sector would like to take some responsibility for the assessment process. Learners are encouraged to become actively involved with the selection of assessment material for their portfolio. The role of the learner in this regard is repeatedly emphasised by NCVA.

ASSESSMENT RATIONALE

The module descriptor

The NCVA decided, as a result of this consultative process, to use a criterion referenced assessment approach. A module descriptor which included the purpose, general aims, units of content, learning outcomes, performance criteria, and assessment methodology was developed. The structure of this descriptor was influenced by the SCOTVEC experience (NCVA, 1992). The initial draft of the Foundation level mathematics module descriptor resulted from the work of a representative group from the further education sector. A feasibility study was then initiated with this module descriptor.

Specific Learning Outcomes (SLO's)	Performance Criteria (PC's)
<p>2.5 Multiply decimal numbers by natural numbers</p>	<p>multiply a four-digit decimal number with decimal places by a two-digit natural number, e.g. 45.67×12.</p>
<p>2.6 Multiply two decimal numbers</p>	<p>multiply a four-digit decimal number with two decimal places by a two-digit decimal number with one decimal place, e.g. 45.67×1.2.</p>
<p>2.7 Divide decimal numbers by natural numbers</p>	<p>divide a four-digit number with two decimal places by a single-digit natural number, e.g. 45.67×2.</p>

Figure 2. Sample SLO's and related PC's. (NCVA 1997)

(The SLO is a specific piece of mathematical knowledge. The performance criteria give a specific direction regarding the activity that the learner must perform to demonstrate mastery of this piece of mathematical knowledge to the required standard.)

The module descriptor was issued to a selected number of providers of Foundation level mathematics. The study resulted in few alterations. NCVA issued the Draft Foundation level module descriptor to over one hundred providers including Youthreach and VTOS centres, Adult Education and Community Education Centres. This consultative, collaborative process concluded with the publication of the Foundation Level Mathematics module descriptor in September 1997.

Portfolios

A set of guidelines for assessment of foundation level mathematics emerged from this consultative process. These include active participation by learners, ability to show learners progression, a willingness/ability to take responsibility for their own learning and other characteristics consistent with *adult learners*. The use of portfolios offers a genuine means of achieving these goals (Asturias, 1994). They also supply concrete evidence for examination by others - an important consideration in the circumstances. This means that they can be fitted into a national scheme for assessment and standards.

Cross moderation

The NCVA strategy is designed to integrate local assessment with a national system of quality and standards. Thus the learners produce assessment evidence at local centre level which is collected in a portfolio over time. When this is deemed to be adequate for certification purposes it is submitted to external moderators at a national cross moderation session. Here selected tutors assess the portfolios and decide whether they reach the standard or are returned.

IMPLEMENTING PORTFOLIO ASSESSMENT

Tutor as assessor

NCVA acknowledge that learners produce quite a lot of material during the course of their mathematics programme. This consists of learning as well as assessment material. The course work would initially be collected in a folder, ring binder, etc. However, when it comes to the 'portfolio for assessment' the learner and the tutor select the assessment material from this course work folder and construct an assessment portfolio. This means that the tutors are responsible for;

- developing a mathematics programme that is relevant and challenging for the learners,
- constructing assessment tasks/exercises,
- setting times for assessment tasks/exercises to be taken by the learners,
- evaluating the evidence generated by the learners,
- supporting the learners in selecting material for the assessment portfolio.

The selection of material for the assessment portfolio can take place during the course of the programme or at the end depending on the tutors and the learners. In most cases this activity is carried out at the end of the mathematics programme and in the majority of cases the tutor is left with this task. While portfolio assessment means that the tutor is now an integral part of the process the weight of responsibility for the material selection should go to the learner.

Portfolios

In the early stages a substantial volume of material was included in the assessment portfolio. This included learning as well as assessment material. NCVA advised providers and tutors that one piece of evidence related to the mastery of each learning outcome is sufficient. This meant that tutors and learners could be very precise regarding the selection of material for the portfolio. This advice resulted in an immediate slimming down of the portfolios.

While it was increasingly encouraged that tutors should be creative and innovative regarding their assessment approaches invariably they resorted to a set of assessment exercises determined only by the sequence of SLO's outline in the module descriptor. Experience with tutors at in-service seminars indicated an understanding and a value for realistic approaches to the assessment of mathematics, however, there was little evidence of this espoused theory in the assessment material. For this reason the evidence of achievement presented in Appendix 1 is quite normal. It is singularly functional - it indicates mastery of a specific learning outcome.

The integrated project

In an effort to generate creative approaches by which foundation level mathematics can be assessed examples of integrated assignments/projects were described at in-service seminars. The purpose of integrated assignments is primarily to show learners that mathematics happens and is required in contexts other than the mathematics classroom. This becomes obvious if tutors of vocational skills, e.g. woodwork, metalwork, cookery, picture-framing, etc., identify activities in which mathematics is required to complete a task. (See Appendix 2 for example of integrated project.) The artefact as well as the planning sheets, the written calculations and any other support material would suggest mastery of particular mathematics knowledge. Even without the support material the artefact itself, if it was put together independently by the learner, would implicitly indicate the requirement and therefore the mastery of some mathematics.

The integrated approach is developed at two levels

1. The learner is expected to learn and record mathematical skills that are used in different domains e.g. metalwork, cookery, woodwork.
2. At the organisation level a number of teachers are involved in the development of these mathematical skills. This presents a more realistic view of the impact mathematical skills have on these subject areas. It also helps to erode the compartmental mind-set which had been cultivated over many years of practice.

Cross moderation

Tutors bring their learners' completed portfolios to a central location. An uneven number of tutors is seated round a table. The portfolios are then presented for assessment according to the standards laid down by the performance criteria in the module descriptor. A table facilitator enables the process. It must be pointed out that the tutors who present their learners' portfolios have already assessed them. The cross moderation process accepted or referred the tutor's judgement.

DISCUSSION

Tutors are now given the responsibility to assess, in a formative way, evidence of achievement. This is a new idea because the assessment method for state accredited certificates, up to this point, has taken the form of a state supervised 'sit down' examination. The examination papers are then assessed under state supervision. However, NCVA moved tutors centre-stage in the role of assessor. The NCVA are satisfied that tutors involved with the teaching of Foundation level mathematics are competent assessors of the standards outlined in the module descriptor. This is not, however, a total leap of faith: in-service training is provided for all tutors who assessed Foundation level mathematics.

Many tutors found that a very structured sequence of learning and assessment, mimicking that in the module descriptor, was not catching the imagination of *adult learners*. Many adult learners are engaged in other programmes such as woodwork, cookery, metalwork, etc. These subjects provide obvious contexts in which mathematics can be both learned and assessed. Some tutors are very innovative in designing realistic tasks that produce evidence for a number of outcomes from a range of units in the module descriptor. However, many tutors still take a minimal interpretation and ask their learners to produce evidence of achievement of each learning outcome individually and in sequence. Few benefits can come from 'atomising' a mathematics programme for the purpose of assessment.

Some tutors saw the module descriptor as a course or programme. NCVA pointed out that the module descriptor is not a programme and advised tutors to accommodate the assessment requirements, with minimal alterations, within the mathematics programme they were already teaching.

The cross moderation process had many positive outcomes. It helped to establish a standard for the portfolio of evidence at Foundation level. There was an opportunity for tutors to see other ideas related to assessment. Tutors who attended these sessions became more confident: they were now on the right track. The exercise unofficially began a process that developed the skills of many of the future *external examiners*.

CONCLUDING REMARKS

There is no doubt that portfolio assessment has been a qualified success with Foundation level mathematics. However there are still some areas that need to be addressed. O'Donoghue (1995), which deals particularly with this area of mathematics education in the Irish context, reports on a number of decisions made as a result of the experience of the Applications-Orientated Mathematics project (AOM). It is clear that NCVA portfolio assessment addresses the majority of these concerns such as

- developing a significant and relevant programme for the client group
- making the programme accessible
- examinations can be used as a method of assessment if required by the client group
- the use of calculators and computers is encouraged
- flexibility around assessment requirements and regulations
- recognised certification for the client group.

However there are a number of concerns arising from the AOM experience which are not addressed.

- Employers are not involved in the selection of topics, examples of application, etc. The credibility that this involvement would add to the Foundation level mathematics certificate is obvious.

- A supported self-study strategy which would keep things within the control of the learners. This would enable the concept of self-managed and *life-long learning* to become more realistic for the learners.

- Develop well-structured practical application exercises which would include integrated projects. This topic has been raised consistently by tutors at in-service seminars. While in the context of the AOM experience the materials would be used predominantly by the learners, this material would be used by the tutors as well as the learners at Foundation level.

Many of the problems related to the module descriptor arise from a lack of specification, information and guidance. This issue is clearly addressed in the National Council for Vocational Qualifications in England. The NCVQ Application of Number (NCVQ, 1996) is supported with range statements, evidence indicators and guidance. These additions help to make the requirements of the unit clearer. The NCVQ model can provide many ideas for improving and developing the NCVA module descriptor.

Many of the remaining concerns can be addressed within the context of an improved support provision. The NCVA has recognised the need to improve its support by designating centres with specific support roles e.g. the AOM project at Tipperary (NR). Vocational Education Committee is providing in-service and curriculum development support for Foundation Mathematics at a national basis.

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APPENDIX 1

Evidence of achievement extracted from Mathematics Foundation Level portfolio.

Group 6 2/3/96

$$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6} = \frac{1}{3}$$

$$4 \times \frac{1}{2} = \frac{4}{1} \times \frac{1}{2} = \frac{4}{2} = \frac{2}{1} = 2$$

$$\frac{5}{8} \times \frac{1}{2} = \frac{5}{16}$$

$$\frac{2}{3} \times \frac{9}{6} = \frac{18}{18} = 1$$

S.L.O. 3.5.

$$\frac{2}{3} \times \frac{3}{5} = \frac{6}{15}$$

$$\frac{1}{4} \times \frac{8}{3} = \frac{8}{12}$$

$$\frac{6}{5} \times \frac{3}{2} = \frac{18}{10} = \frac{9}{5}$$

$$\frac{3}{8} \times \frac{8}{3} = \frac{24}{24} = 1$$

$$\frac{20}{1} \times \frac{3}{5} = \frac{60}{5} = 12$$

APPENDIX 2

This is an example of an integrated mathematics/woodwork project. The completion of the drawing and the construction of the woodwork artefact implicitly demonstrates the achievement of a number of Foundation Level Mathematics outcomes.

Woodcraft Project Integrated with Mathematics Outcomes 6.1, 6.2, 7.2, 7.3, & 7.7.

