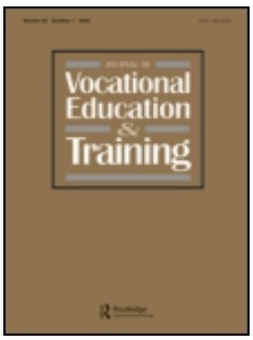

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Taylor & Francis Group

Journal of Vocational Education and Training

ISSN: 1363-6820 (Print) 1747-5090 (Online) Journal homepage: https://www.tandfonline.com/loi/rjve20

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To cite this article: Ian R. Cornford (1997) Ensuring effective learning from modular courses: a cognitive, Journal of Vocational Education and Training, 49:2, 237-251, DOI: 10.1080/13636829700200014

To link to this article: https://doi.org/10.1080/13636829700200014

Journal of Vocational Education and Training, Vol. 49, No. 2, 1997

Ensuring Effective Learning from Modular Courses: a cognitive psychology-skill learning perspective

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ABSTRACT Modular courses have been widely implemented as part of the competency-based training agenda. However, there is emerging concern that modular courses are not promoting effective learning although pragmatic considerations indicate they will continue to be widely used since there appear to be numerous advantages associated with their employment. A major inherent weakness of modularisation as a method of content organisation is it tends to fragment knowledge. The cognitive psychology and skill learning literatures, largely ignored in the development and implementation of competency-based training, indicate principles, which if followed, will help to ensure effective learning from modular courses. Particularly salient are the needs to ensure adequate practice and the integration of modules if effective problem solving is a desired objective. Stressed are the need for the teaching of 'learning-to-learn' strategies before modular courses are commenced and the importance of assessment to integrate knowledge gained from modules. Bruner's spiral curriculum concept, it is argued, is particularly useful in ensuring adequate practice and effective integration in modular course design.

Introduction

The adoption of government policies centred upon competency-based training has provided the impetus for the development and implementation of modular courses on a large scale in vocational education, especially in Australia and the United Kingdom. Modularisation has been judged as a key element in the development of effective vocational education systems in Scotland and Sweden, and worthy of emulation in other countries (Vickers, 1994). It should be recognised, however, that modularisation is not a recent phenomenon. This approach to structuring content for presentation has been used for many years (Finch & Crunkilton, 1984). While there are many benefits springing from modular approaches to content organisation and presentation, like all

strategies employed in education, this has specific strengths and weaknesses.

The publication recently of a brief article entitled "Is modularisation producing rotten eggs?" (Thomson, 1995) in an Australian training journal produced a spate of letters to the editor. In his article Thomson questioned the effectiveness of real learning outcomes from employment of modular courses, the assessment procedures currently employed and the relative advantages of modular courses vis-a-vis traditional courses. A critical stance would appear to be vital in the establishment and maintenance of any effective educational system, yet the responses to that article indicate the extent to which modularisation has assumed an almost sacred status. Because modular courses serve valuable administrative purposes, it is assumed that the learning modular courses produce must be effective and their effectiveness cannot be questioned!

Pragmatic considerations indicate that modularisation, which has significant advantages, is likely to continue to be an important mode of content organisation and presentation in vocational education systems in the foreseeable future. In the light of the fact that there are concerns surfacing concerning the effectiveness of learning outcomes with this mode of presentation (e.g. Ainley, 1993, p. 91; Young, personal communication, 1994; Hager, 1995, p. 145; Thomson, 1995), it seems appropriate to adopt a critical attitude and draw upon the psychology of learning to provide insights to assist in effective modular course design and implementation. This concern is being expressed both in the UK (Ainley, 1993; Young, personal communication, 1994) and Australia (Hager, 1995; Thomson, 1995), countries where competency-based training and modularisation have come to be closely associated. Those expressing concern reflect a number of different perspectives ranging from competency-based training (Hager, 1995), general effectiveness of training (Thomson, 1995), sociology (Ainley, 1993) and sociology of education (Young, personal communication, 1994).

This article considers the advantages of modularisation, its links to behavioural approaches and its inherent weakness, before drawing upon cognitive psychology, skill learning and the development of expertise literatures to provide guidelines. To date the psychology of learning literature has been almost entirely neglected in the development and implementation of competency-based learning policy.

Advantages of Modularisation

Modularisation of courses involves the packaging of course content, either theory or practical, into shorter, logically self-contained units which together cover the content which would be covered by a conventional, longer course. To its proponents this presents the ideal of being able to assess learning and performance before moving onto a new topic or unit

for which the initial module is prerequisite knowledge. When failures occur in modular courses, those who have failed will not be required to waste time covering units which they have already passed, as happens with more traditional courses. Instead they can concentrate upon those modules in which they have not been able to demonstrate competence (Finch & Crunkilton, 1984).

The establishment of clearly identified goals attainable within a specific time frame has attractions. However, one of the greatest advantages is the flexibility which is created by the modularisation of courses. Vickers (1994) sees the employment of modularisation in both Scotland and Sweden as being very successful in linking secondary schooling, adult education and training. Shorter, self-contained units lend themselves to advantages in terms of scheduling, choice of modules to satisfy the training needs of individuals and individual employers, and review of courses to ensure technological currency. When technology is changing quickly as at present there is a need to continually update courses. In Sweden, it is considered that it is easier to replace one module than a whole course, while in Scotland SCOTVET replaces some 10% of modules per annum (Vickers, 1994, pp. 39-40).

For both employers and students there are advantages in having assessable units presented in concentrated form. Provision of short, self-contained units permits students to enrol for as many or as few as they consider that they can handle. This can be particularly useful where busy phases of employment or personal responsibilities leave less time for undertaking study courses. Students can select those modules which are most relevant and omit those which are not considered of interest or importance. Ainley (1993, p. 91) considers that “independent and individual study across traditional subject boundaries will be facilitated” through employment of modular systems. Furthermore, there is the potential to meet the needs of industry relatively quickly as modules can be designed to satisfy employer demands for skills and knowledge which are required to be developed immediately.

The modular approach lends itself particularly well to short courses and courses which have been developed for specific training purposes such as to provide specific training in skills relating to specific occupations or industries, for the most part being driven by local demand (Ainley, 1993). In such cases, the course content tends to be clearly defined and is used to provide a specific service rather than to be part of long-term training for broader professional development. That is to say, it tends to be used to effectively ‘top up’ already existing skills and knowledge. Currently, however, there is ample evidence that modular courses are being widely used to develop skill and knowledge bases. With block-release and students in distance education, modularisation often has been used in the recent past.

There are major administrative advantages stemming from the approach from an education provision perspective. Modular course content can readily be assessed and credit given, hence recognition of prior learning and credit transfer are facilitated. The advantages also extend to efficient use of specialist teacher resources. The self-contained nature of modules means that they can be programmed with more subject experts each presenting his or her speciality while other teacher/trainers present the module(s) in which they possess specialist knowledge. While problems may exist with sequencing when there is the logical need to study modules in a fixed order, in other cases where this is not such an important consideration, greater flexibility is possible in timetabling.

Of all these advantages of modularisation, the overwhelming majority are essentially of an administrative nature. Although it is frequently assumed that this form of content organisation and presentation has advantages in terms of learning effectiveness, there do not appear to be any empirical, longitudinal studies in vocational education which conclusively demonstrate this. Skill learning is of such vital national and social importance that there cannot be the luxury of waiting until such longitudinal evidence is assembled. Rather, there is a need to respond to concerns (Ainley, 1993; Hager, 1995; Thomson, 1995), and attempt to remedy identifiable problems before the longer term skill development of many in a generation of vocational students is less satisfactory than is desirable.

Modularisation and Connections to Narrower, Behavioural Approaches

The association of modular course and behavioural approaches to competency-based training has been recognised for a long time (Finch & Crunkilton, 1984). Inspection of a range of modular courses currently employed in different specialist areas is likely to reveal a high proportion heavily influenced by earlier behavioural theory. The continued influence of behavioural principles seems to have occurred because many modular course designers lack a thorough understanding of cognitive and affective elements which have been incorporated into more recent competency-based learning positions to overcome the narrowness of these earlier, strictly behavioural approaches (e.g. see Hager, 1995). Such recent modifications reflect the very strong interest in cognition and problem solving, and post-Fordist organisation and management systems which require the training of workers who are flexible, and possess substantial problem-solving abilities.

Despite the cognitive elements in more recent, sophisticated statements of competency-based ideals, the tendency to develop relatively narrow, behavioural conceptualisations of modularisation is reinforced, and likely to continue to assert itself unless replaced by guiding principles

which are specifically orientated to cognitive aspects of training. This is because competency-based training is essentially concerned with performance. There is also a need to recognise that modularisation, on account of its fundamental characteristic of division into smaller units, has the inherent potential to fragment bodies of related information. It has been argued that there is the danger that vocational programmes driven by labour market demand may result in "a loss of theoretical generalised knowledge in favour of specialised knowledge applicable only to occupational tasks not conceptually related to one another" (Ainley, 1993, p. 91). The objectives of broader conceptions of competency-based training which involve effective problem-solving cannot possibly be achieved under these conditions.

Literatures in the areas of cognitive psychology, skill learning and the development of expertise provide clear principles to guide course development and help combat the inherent tendency for modularisation to fragment learning into unrelated units.

Some Principles for Effective Learning and Course Design Indicated by Educational Psychology

Theory and research into both skill learning and the development of expertise provide an indication of the phases of development that need to be considered if genuine skilling, that is training an individual capable of performing to a high level and acting independently and effectively as a problem solver, is an objective. These two research literatures are complementary rather than in competition. The stages in the development of expertise reveal the overall picture in the development of complex skills associated with the particular profession, while the stages in skill learning theory provide a clear indication of how learning proceeds for individual skills which ultimately integrate to produce expert behaviour and problem solving (Cornford, 1993).

The stages progressed through in the development of expertise are novice, advanced beginner, competent, proficient and expert (Dreyfus & Dreyfus, 1986; Berliner, 1988). The first three stages are concerned very much with the learning and application of new information. Individuals at these stages of development are characterised as being controlled very much by rules, and by relative lack of flexibility in dealing with data and problem-solving. The later stages of proficient and expert are qualitatively different and draw more upon intuition which is closely linked to automatic data processing and problem-solving based upon elaborate schemas or mental models. In a period in which skill effectiveness is of great concern, the level of competence, which is only a middling level of skill performance, is really inappropriate as a training objective. The stage of proficient appears much more appropriate and a realistic goal for training (Cornford & Athanasou, 1995).

The skill learning theory of Fitts (1964, 1968) identifies three stages or phases in the learning of individual skills. The first is a cognitive phase in which components and their order are identified along with basic standards of excellence. The second is a practice fixation phase in which the skill is refined and consolidated into long-term memory through practice and feedback, and the third an autonomous phase where the skill comes to be automatically performed. The autonomous stage is quite important in human skill learning and effective performance since it frees up conscious working memory with its limited capacity to concentrate on incoming data and allows problem-solving to take place quickly and efficiently (see Sweller, 1993).

Effective learning at the cognitive and practice fixation stages involves the development of schemas or mental models through the integration of new information with past learning, the recognition of the individual parts of a learning task and their meaningful integration into a comprehensible whole (Sweller, 1993; Weinstein & Mayer, 1986). Both motivation and knowledge of learning-to-learn strategies, that is will and skill, are important here in the development of effective schemes with elaboration, repetition and organisation of incoming information key elements (Weinstein & Meyer, 1994). An effective learner here is an active learner making effort to engage in coding, rehearsal, self-testing, and integration of past and present learning activities (Chi et al, 1989; Weinstein & Mayer, 1986). Research in these areas stresses the importance of provision for adequate practice and provision of teaching how to employ effective learning-to-learn strategies and metacognitive monitoring processes (Weinstein & Meyer, 1994). Overall, this research suggests that deliberate, conscious interrelationship of units or modules needs to be a key principle for module planning and it again reinforces the importance of adequate practice and feedback.

In the process of learning and developing effective schemes to guide performance, forgetting and retention need to be considered consciously in the design of courses. Quite considerable amounts of information are forgotten quite quickly (see Anderson, 1990). This will occur unless there are specific efforts to practise, to revise, go over information and engage in overlearning to counter this natural tendency which seems to stem from the limited capacity of working memory and subsequent cognitive overload (Sweller, 1993).

The extension of initial performance schemas to encompass problem solving elements requires the development of cognitive and metacognitive skills which are specifically related to problem solving identification and solution. In this process episodic and case knowledge built up over many years of seeing unusual permutations of success and failure in skill performance are important (Berliner, 1991). The development of expertise literature indicates that novice and advanced beginners are unlikely to have much understanding of problem-solving skills and that adequate

practice of relevant subskills is essential to build the knowledge base, a necessary foundation for understanding and problem-solving (Berliner, 1988; Cornford, 1993).

Design of modular courses needs to ensure that there is sufficient time for the teaching of theory relevant to mastery of skills and sufficient practice to ensure that the skills become securely established. Problem-solving skills will only become possible if there is a good understanding of relevant theory and how it integrates with practice. This indicates that the designers of modular courses also need to plan content and process very carefully, bearing in mind both the characteristics of students and the relevant level of expertise which it is aiming to develop. The limitations of learners at different levels must be observed. There also needs to be incorporation of teaching-learning strategies which will assist in development and consolidation at the existing stage, and facilitate progression to higher stages in the development of expertise.

Problems with Modular Courses: practical considerations

Much of the research into human learning from cognitive and skill learning perspectives indicates that learning does not always or often follow a strictly linear, rational logical analysis or proceed quickly. The complexity of human learning, as for example, with retention and forgetting, and the development of plateaux in skill learning, precludes nice, neatly packaged solutions.

Modular courses, because they tend to be intensely concentrated particularly in terms of time and content, rarely have enough time allocated to ensure adequate practice and feedback. The author frequently encounters teachers of modular courses who complain about the number of students who have not securely learned skills from previous modules which are essential prerequisites for success on the current module. Adequate practice and feedback are elements absolutely essential to ensure retention in long-term memory and refinement of initial schemas to more sophisticated levels to assist in later problem-solving and use with difficult skill applications.

One assumption that many modular courses presently reflect is that effective learning proceeds via self-contained chunks of information. However, as indicated above, research into the development of expertise (Berliner, 1988), schemas and skill development (Sweller, 1993), and the cognitive processes engaged in by more effective learners (Weinstein & Mayer, 1986; Weinstein & Meyer, 1994; Chi et al, 1989), indicates clearly that successful learning is dependent upon the integration of units of information into coherent wholes to form schemas, particularly if effective problem solving is a desired outcome.

Modules, however, by their very structure, tend to fragment knowledge rather than to integrate it. Practical experience indicates that,

where there are instructions to review previous modules, time pressures in teaching content in the new module tends to reduce the review to token coverage. Few courses adopting modularisation specifically plan for time and special modules to review past learning relatively extensively so that learners can easily construct links. Yet modules devoted specifically to review and integration appear necessary to ensure that adequate attention is paid to these aspects of learning and teaching, and also that time is provided for these activities.

Specific planning for integration and revision becomes even more of an issue with modular courses than with conventional courses, which tend to be presented at regular time intervals, because modules may be and often are widely separated over time. Even the most capable students may have difficulties recalling relevant theory which they have stored in long-term memory because that module may have been taken some time ago. Also modules are often designed to be interspersed with practical application and on-the-job experiences. This brings about proceduralisation of learning (Anderson, 1982) and the automatisation of skills (Fitts, 1964, 1968) which remove many elements from conscious awareness after considerable practice. Thus, there is a need for incorporation of review of past relevant theory learning to assist students to consciously construct links between old and new information to facilitate the development of schemas and ultimately problem-solving skills. Without conscious planning for substantial review segments at the beginning of new modules, modular courses are unlikely to be as effective as they might be.

Even where the modular courses are used with the objective of changing attitudes rather than the development of specific skills, schema refinement through application and feedback is required. For example, Hall & Hord's (1987) Concerns-based Adoption Model (CBAM) for the implementation of innovation and change in schools indicates that there are six different, progressively more complex stages involved in the acceptance and effective diffusion of innovation, all of which involve schema refinement over time through practical implementation and experience.

While substantial time gaps between modules and skill development through on-the-job experiences may result in forgetting of relevant information, and so impede integration, these on-the-job experiences can be turned to advantage through adequate forward planning for creating integration. Integration of meaning and understanding are related to experience of uses and specific skill contexts so use should be made of preparatory and follow-up exercises to modules. Possible activities, which could be either preparatory or follow-up, would include having students talk to more experienced workers, do reading and research in trade journals or references to integrate the theory and practices taught in modules, and relate work covered in modules to workplace practices in

the individual's workplace and as used in other workplaces within the same industry or field. Clearly established student guidelines with such exercises would ensure that they are productive and serve the objectives intended.

The Importance of Learning-to-learn Skills

Concentration upon subject matter in limited time frames, as tends to occur with modular courses, places demands upon students for relatively quick and effective acquisition. Designers of modular courses often make incorrect assumptions about the readiness of students to learn from content in modular courses and their ability to engage in meaningful self-testing, self-interrogation, and coding and rehearsal strategies which are necessary for effective learning and storage in long-term memory (Weinstein & Mayer, 1986; Weinstein & Meyer, 1994). It is now being realised that such skills are required for all post-compulsory education students, and that includes those enrolled in vocational trades courses, not just those who are enrolled at universities. The reality is that many students are studying in the vocational education area because of deficiencies in learning strategies and inability to succeed in more academic streams.

The prospect of continuing technological change, and the need for present and future generations of learners to engage in life-long learning to keep abreast of developments, mean that students need to be prepared for effective life-long learning by being taught how to use learning-to-learn strategies, libraries, professional journals and specialist reference sources.

It is possible to teach learning-to-learn strategies either in conjunction with subject content in normal courses or as separate specialist courses (Weinstein & Meyer, 1994). Given the time restrictions and sharply focused nature of modular course, it seems preferable that these learning-to-learn skills be taught and assessed in serious ways to ensure mastery in separate modules before courses commence. Indeed, there is probably need for these to be prerequisites and students be required to prove mastery of these skills before they are allowed to enrol in vocational subject speciality courses. The recently developed Strategic Assessment of Readiness for Training (START) instrument (Weinstein & Palmer, 1994) holds promise in assisting the trainer to determine student readiness to engage in learning.

The Problem of Inadequate Formative Assessment Processes in Modular Courses

This problem of insufficient time devoted to practice and feedback provision is not restricted to modular courses. It is also a major problem even with many longer, conventional vocational education courses

(Cornford, 1993). However, the problem is somewhat compounded in modular courses, again because of the time element. In conventional courses over a semester or year there is often more time to assist students via resubmission, feedback and coaching before the period of final assessment. These avenues are less available in the more pressured, tightly constructed modular courses where assessment occurs at the end of each module. When modular courses are also competency-based there are additional problems. As Hager (1995) has pointed out, competency-based learning is really concerned with summative rather than formative assessment. In effect, this means ignoring the importance of formative assessment feedback, which is absolutely essential in effective skill learning (Fitts, 1964, 1968) and the development of expertise (Berliner, 1988; Cornford, 1993), to just concentrate upon the final outcome.

Importance of Assessment and Nature of Assessment Goals in Modular Courses

Assessment is central in modular courses driven by competency-based, product oriented concerns. While teaching to the test may be derided in general education circles, the clear focus in modular courses, especially competency-based ones, is upon performance to pass the module assessment. However, a number of problems are compounded by a behavioural conceptualisation of one assessment task at the end of a module with there being no revisiting of the module at a later stage or later parallel assessment if the module is passed. These problems fall into two distinct, but related groupings of validity and reliability of assessment, and the provision of formative feedback as just outlined.

Valid and reliable judgement of skilled performance involves assessment of consistency of performance over time, whether in terms of competency-based learning approaches or stages in the effective development of skill or expertise. Consistency of performance cannot be judged from just one assessment. ‘One-off’ assessment, particularly where there has been insufficient opportunity for extensive practice and feedback and observation by the instructor over relatively long periods of time, may result in fluke performance which does not reflect the true nature and stability of skills supposedly learned.

This problem of validity and reliability of assessment is complicated further where there is assessment of relatively long chains of subskills and one instructor to one student assessment is not undertaken. Since one-to-one assessment is very expensive and time consuming, in practice it is often not undertaken. Ideally, theoretical understanding should be tested as well as performance with any judgement of success being dependent upon both successful demonstration of underlying principles and ability to translate this into effective practice.

Many of the problems of learning and assessment associated with modular courses can be overcome through planning for multiple assessments. Multiple assessments of skills provide the opportunity for formative feedback and also offers the chance of more valid and reliable assessment. The skill learning and development of expertise literatures indicate that the development of skills and of putting skills together to solve problems and develop problem-solving techniques and strategies should, in fact, be educational and educational assessment goals. Bruner's spiral curriculum concept offers guidance for the development and integration of modular courses, and the development of appropriate assessment programmes.

Modular Course Design and Bruner's Spiral Curriculum

Bruner (1971) considers that effective learning is most likely to occur when learners are exposed to subject content numbers of time when the basic skills are returned to with additional complexity as students develop and move through a course or curriculum. This is the concept underlying the spiral curriculum which was developed in a context of fostering meaningful, real world learning and problem solving. Although originally formulated with reference to cognitive skill acquisition and school learning, it is particularly pertinent for vocational education where effective skilling is the desired objective.

Structuring courses and organising material by this concept provides the opportunity for practice and repetition with gradually increased complexity. Such processes are very much congruent with research and theories which highlight the limitations of the novice learner (Berliner, 1988), the gradual increase in complexity of schemas as they are constructioned (Sweller, 1993), and refinement of skill learning through practice and feedback (Fitts, 1964, 1968). Many 'real-world' skilled occupations reflect this principle and involve gradually building up from basic skills. Use of this spiral curriculum concept has the potential to guide instructional design, particularly the analysis and grouping of content into separate modules, and the establishment of assessment programmes which help focus both teachers and students upon the integration of content in separate modules.

However, it should be noted that careful selection of assessment tasks to help ensure integration of knowledge from disparate modules separated in time should not be viewed as a substitute for sections within or separate modules which seek to integrate theory and develop problem-solving skills. The whole is more than the sum of the parts and, while it may be convenient for a range of administrative reasons to break the whole subject into modules, there needs to be a conception of those modules fitting together to form a coherent, intelligible and integrated whole.

Furthermore, if we are really serious about training for problem-solving and skills leading to best practice, we need a final assessment to cover the attainment of all objectives in modules in a course and test for integrated skills and problem solving. The tradition of rigorous testing of learning at the completion of a course before certification is gained, that is summative assessment, as practised in many European countries, but especially Germany (see Cantor, 1989), helps ensure, not only integration of knowledge and maintenance of high standards, but substantial pride in the gaining of those credentials.

An Example of a Course Successfully Integrating Content from Earlier Modules and Repeating Assessment

The New South Wales Department of Technical and Further Education's Certificate IV in Professional Cookery (Patisserie) provides illustration of how there may be successful integration of knowledge and skills from different modules and repeated assessment at different levels. There are a number of separate modules offered in this course including Baked Pastries, Afternoon Tea Fancies, Gateaux and Torten, and Plated Desserts and Dessert Trolley Operations. The last two modules essentially involve the making and presentation of fancy cakes, biscuits and tarts. Basic techniques, knowledge of handling and storage of ingredients are assessed in the first module, Baked Pastries, and then are built upon in all the later modules.

In Afternoon Tea Fancies, the module after Baked Pastries, students learn to prepare a range of flans and pies drawing upon the pastry making skills that they have learned from the basic Baked Pastries module. Thus, pastry making is re-assessed, but at this stage presentation and preparation of fillings are given more consideration because the basic pastry making skills have been subjected to tightly focused assessment earlier. Also in Afternoon Tea Fancies cake mixtures are covered. Then both pastry and cake making skills are extended further with more complex techniques and handling of ingredients, combinations of pastry and cake in the same product, and higher levels of decoration and presentation skills demanded in the Gateaux and Torten, and Plated Desserts and Dessert Trolley Operations modules.

Careful initial analysis of skills and sequencing of difficulty in this Patisserie course have permitted earlier knowledge and skills to be repeated and integrated, and re-assessed in subsequent modules thus allowing for formative assessment over the longer term. Students who successfully complete the final module of Plated Desserts and Dessert Trolley Operations also in effect receive a summative assessment of skills taught in this course. In this particular course, this summative assessment is not formally recognised as such, or carried out as rigorously as would occur in France and Germany.

With this Patisserie course foundation skills are assessed before being integrated into more complex sets of skills in succeeding modules. This assessment of competence in basic skills, before the integration of these skills at higher levels, ensures it is possible to identify problems at specific stages in skill development. Students receive statements indicating competence for the modules and levels at which they achieve. If they choose not to proceed to a later module or fail at a higher level they still retain that lower level statement of attainment. Provision is made for recognition of prior learning and students can be exempted from a module if they can produce evidence of competence in work covered in that module for which they are seeking exemption.

Vocational educators generally recognise a hierarchy of difficulty in occupational skill development and learning, and the need for careful sequencing; hence, there is a natural tendency to develop an optimal order of module presentation. If it is not possible to carefully analyse and interrelate skills, and sequence modules as in this Patisserie course, and modules are taught somewhat randomly, integration may be more difficult, and integration and summative assessment may need to occur in a final module specifically designed for this purpose. With random presentation of modules, the advantage of administrative flexibility is likely to have been preserved at some cost to effective learning, and feedback from formative assessment over a number of occasions will be diminished or may not occur.

Conclusions

Research and theory in the areas of the development of expertise, skill learning and cognitive factors affecting learning provide a base from which to judge modular courses, and indicate important principles which need to be adhered to if modular courses are to result in substantial, meaningful learning and the development of problem-solving abilities. Modular courses do have certain strengths, and will continue to be developed and implemented to satisfy specific training needs. In order to ensure that modular courses are as effective as possible there are a number of specific recommendations which need to be observed in constructing and designing modular courses.

1. It is highly desirable that learning-to-learn skills be taught and mastered before students commence modular courses.
2. Modularisation tends to fragment units of knowledge. To overcome this inherent tendency course design must:
   (a) allow time for adequate revision to overcome forgetting;
   (b) plan to integrate module knowledge with the workplace context;
   (c) have modules specifically designed to integrate theory and develop problem-solving skills.

3. Bruner's concept of a spiral curriculum provides sound guidance in course design to ensure meaningful repetition, practice and assessment.
4. Forms of assessment used with modules are important in terms of guidance offered to teachers in presenting courses, as a means of integrating disparate modules into a meaningful whole, and providing evidence of consistency in skill application.
5. Serious consideration must be given to ways of ensuring that adequate time is planned for practice and feedback before summative assessment takes place.

Modular courses designed with due consideration of these factors and properly implemented will have the potential to ensure effective learning while still retaining all the advantages of modularisation.

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