Appraising the Integration of Training and Education in Masters-Level Apprenticeship Courses

Stephen G. Barker, Cranfield University, United Kingdom

The Barcelona Conference on Education 2024
Official Conference Proceedings

Abstract
The advent of Level 7 (L7) apprenticeships over the past decade has presented a number of challenges and opportunities to the UK Higher Education sector. Whilst new market(s) were opened to universities and other educational establishments, the differences between apprenticeship training and 'standard' masters-level education needed exploration and quantification and a means had to be devised to deliver training into the marketplace. Two primary approaches to achieve this were implemented, the first being the creation of dedicated apprenticeship-only training courses at L7, the second being to broaden the scope of existing masters courses to include apprenticeship training. In this latter approach, apprentices are taught side-by-side with masters-only students, and this means that a single course needs to be able to successfully deliver educational and training needs. This presented a significant challenge, and one that needed to be perfected over time. As a case study, this paper considers how Cranfield University's Systems Engineering MSc course team approached this task. The process by which the existing course was modified and subsequently revised in the light of experience is documented focusing upon the need to meet apprenticeship aims, and knowledge, skills and behaviour (KSB) criteria stipulated by the relevant apprenticeship standard, whilst not adversely affecting the existing educational offering. An appraisal will be made using lessons learned from experience and considering feedback from students, employers, and academics, together with existing literature, to identify successes and potential improvements and recommend suggestions to support continued apprenticeship development and good practice.

Keywords: Apprenticeship, Education, Training

Introduction

The introduction of level seven (L7) apprenticeship training courses to the UK Higher Education sector over the past decade (UK Government, 2015) has offered a number of opportunities to both universities and students. Such courses broadened the range of qualifications available to students whilst at the same time offering an alternative to the standard taught or research-based masters courses such as MSc, MBA, or MPhil. L7 apprenticeships soon grew in popularity (THE, 2018); this rise in popularity of L7 apprenticeships stemmed in part from the fact that apprenticeships were funded by the UK Government's apprenticeship levy (Allen, 2016; UK Government, 2016, 2018a), but was also in part because of the practical, work-based skills focus and generation which they offered to students and their employers alike (University of Strathclyde, 2024). Doughty (2018) quoted Petra Wilton of the Chartered Management Institute as saying: "It's getting [students] the best of all worlds, You get a full degree from a recognised university, work-based learning from an employer and the chance to have a practical impact on your workplace, plus professional recognition through the degree's chartered status – three in one." The Office for Students corroborated this view of L7 apprenticeships, stating a number of benefits for apprentices which included "You will learn skills that are directly relevant to a particular career, and gain work experience in that area. With degree apprenticeships, your degree will be viewed as the equal of a degree earned through traditional routes into higher education, and will be recognised by other employers." (OfS, 2024). In addition to these benefits for employers and students, the L7 apprenticeship scheme also offered clear benefits to universities and other education suppliers. A new market was opened to individuals and employers who might not previously have viewed higher education as a viable or appropriate path to learning and development, whilst a new revenue stream was also accessible. This last was aided by the opening up of the apprenticeship levy in 2018 (UK Government, 2018b).

With such opportunity, however, came challenges. There were two principal approaches to developing apprenticeships – either the creation of new, bespoke L7 apprenticeship courses, or by combining L7 apprenticeship requirements into existing masters-level courses.

Where apprenticeships were incorporated into existing masters-level (L7) taught courses, a means needed to be found of including within the course the necessary structures and information to deliver apprenticeship training whilst not compromising the integrity of the existing taught course. This required consideration not only of teaching and learning content but also of how it could be packaged such that the course would be compliant with apprenticeship requirements in terms of the number of hours an apprentice could study (known as 'off the job hours'). The mix of educational styles also needed to be considered, in that practices normally employed for educational purposes were found not necessarily to work for apprenticeship training, and vice versa. Moreover, it was soon found during development and initial delivery of apprenticeship training that apprentices did not necessarily have the same educational and experiential background of masters-level taught students, and this had to be factored into the planning and delivery of teaching. The learning styles – an essential consideration when developing courses (Barker & Smith, 2021) – of apprentices also had to be analysed and integrated into the teaching and learning plans.

This paper will take these factors into consideration by appraising the task of creating a course which cates for both taught masters students and L7 apprentices based upon learning from experience as a result of developing Cranfield University's Systems Engineering MSc and L7 Apprenticeship course, describing the factors necessary in the development of such a

course, and taking a view of the feedback from both students and apprentices, and also employers and course delivery staff. Conclusions will be drawn as to how continued development of the course can be supported and maintained.

The Nature of Apprenticeships: Factors for Consideration

The structure and teaching learning requirements for an apprenticeship are laid out in the appropriate apprenticeship standard (IfATE, 2024)), with standards being specific to individual topic and educational level (UK Government, 2024a). Standards stipulate the aim and subject matter which apprenticeship courses must cover, detailed in the form of KSB (Knowledge, Skills, and Behaviours) statements, which are the "core attributes an apprentice must demonstrate in order to be competent in their occupation" (Queen Mary Academy, 2024) and which form the basis for assessment at End Point Assessment (UK Government, 2024b). The structure of the MSc and apprenticeship then saw an apprentice study alongside taught masters students for the duration of the course, whilst simultaneously accruing evidence of workplace practice to demonstrate that KSBs had been met, and taking part in three monthly tripartite meetings with the university's apprenticeship tutor and their workplace mentor to ensure that sufficient progress was being made toward the End Point Assessment (EPA). Following successful completion of the MSc, the apprentice would then prepare evidence to be assessed at EPA, and if the outcome was successful, would be awarded the L7 apprenticeship.

This created a number of challenges when combining the apprenticeship requirements with the existing taught course, and these are detailed below:

- L7 apprentices and masters students taught side-by-side
- Need to combine L7 apprenticeship requirements with masters-level education
    - Incorporation of Apprenticeship standard requirements and KSBs
    - Inclusion of apprenticeship content whilst not disrupting flow of 'normal' MSc
    - Linking course content to tri-partite meetings, and apprentices' progress toward EPA

In addition to structural considerations, it was also necessary to consider the expectations of apprentices and their employers, but also of the taught masters-level students, who did not want to be given material which they might deem extraneous and not relevant to their normal study experience. Apprentices (and employers) would reasonably expect the course to be tuned to the learning of KSBs and preparation for and achievement of EPA, but this presented challenges when viewed in the context of the expectations of L7 education, some of which expectations, and associated challenges, are detailed at table one. The potential disparity in experience and level of educational qualification attained between taught MSc students and apprentices presented a particular challenge in that it was found that apprentices benefited from a more structured, gradual learning experience than might otherwise be expected at L7, and that provision of such an approach might frustrate the learning experience of taught MSc students. This required a balance to be struck so that MSc students did not feel as though the course was being specifically catered toward apprentices, whilst apprentices did not feel unsupported by course and module content that either progressed at too rapid a rate or did not contain what they might deem to be essential information needed to support their learning and comprehension. Careful consideration therefore needed to be given information regarding KSBs could be incorporated, linked to taught MSc intended learning objectives (ILOs), and to specific elements of course material. The fact that apprentices were effectively on 'day release' from their normal employment also need to be factored in,

because this proved to be a constraint on the amount of work – or 'Off The Job' (OTJ) hours – that they could be expected to do, and the knock-on effect of this was that it needed to be harmonised across both sets of learners – MSc students and apprentices. This time dimension together with pressure of everyday work created what was to an extent a changeable learning environment in which careful andragogical consideration was needed as to how apprentices – and students – were to be supported (Barker & Smith, 2021; Barker, 2021a).

Table 1: L7 Expectations and Challenges for Incorporating Apprenticeship Learning

L7 education expectation	Challenge for incorporation of apprenticeship
L7 masters-level develops the ability to judge, appraise, defend and justify a situation both individually and in collaboration with others, activities toward the higher end of Bloom's taxonomy (Armstrong, 2010)	- L7 education can be predicated upon basis provided by L6 education, which apprentices don't necessarily have - Apprentices might possess different educational and experiential qualities to taught MSc students
Can often relate to situations where there is no defined or correct solution	- Additional support might be required in educating apprentices and students to deal with uncertainty
Differs from lower-level qualifications in that they are often more foundational in nature and deal with more fixed parameters in situations where there is generally a 'right' answer	- If apprentices lack an immediate lower-level qualification (e.g. L6) then expectations of L7 education might prove challenging
Students must therefore be able to develop and demonstrate the ability to rationalise, develop an answer or approach, and be able to provide the supporting rationale behind their decision-making	- The more formulaic nature of some lower-level qualifications could pose a challenge for individuals needing to make a leap from guidance to self-regulation and independent activity

The need to link ILOs which describe key learning outcomes to be achieved by a course, and KSBs proved to be an additional challenge, for the following reasons:

- ILOs might be fewer in number and broader in nature than KSBs
- Need to map them together to ensure coherence in that
    - Course can deliver KSBs for apprentices whilst
    - Still meeting course and module-level ILOs
    - Iterative process requiring documentation, review, and university validation

ILOs tend toward description of broader activities, such as "Formulate and apply a systems thinking approach to suitable areas of consideration," whilst KSBs can be specific and more formulaic in nature – identifying specific benefits or creating particular logical representations – and this creates a challenge as to how a teaching strategy can be designed to incorporate mechanisms which will deliver against both. The broader aspects of ILOs might be seen to lend themselves to a wider, discursive, more analytic and reflective educational approach, whilst more specific tasks embodied in some KSBs might warrant a more training-focused practice. Careful thought was therefore necessary as to how such approaches could be linked, focusing on a more progressive strategy that incorporated a step-by-step andragogy which built knowledge incrementally by first describing concepts in structure and

behavioural terms to embed essential understanding before proceeding to more advanced philosophical and reflective ideas.

An Andragogy Incorporating Education and Training

There is a dichotomy between philosophies of education and training which needs to be addressed when considering the needs of combining an apprenticeship with an existing masters-level course. Barker (2014) noted that education and training usually require different teaching strategies; education evokes ideas of a 'journey of learning': Plato talked of education as a search for the truth (Plato, 2007), whilst other sources talk of developing an intellectual capacity through evaluation and debate (Kant, 1997), and a process "driven by the self through a need for self-fulfilment" (Barker, 2014). Training, on the other hand, encompasses ideas of "the acquisition of skills, concepts or attitudes that result in improved performance in an on-job situation." (Goldstein, 1980) and "the systematic development of the attitudes/knowledge/skill behaviour patterns required by an individual in order to perform adequately a given task or job" (DoE, 1971). It can be seen from this that education and training have seemingly different requirements; whereas education is concerned with the search for knowledge, training is more specific, systematic, and directed in its nature. Moreover, there is little concept of adequacy in in education. This is still further complicated by apprentices' ability to learn and achieve their chosen L7 qualification being potentially affected by factors such as:

- demographic
- experience
- expertise
- previous education
- Expectations

Employer's expectations of apprenticeship training, taken from feedback received on the course, are that the apprentices' skills will be enhanced in a way which will benefit their organisation by making the apprentice better at their job or role, and a more valuable employee as a result. This might initially be seen as more aligned to the idea of training as described above, underlying improvements in specific skills is the need to understand, appraise, and evaluate how to use those skills to better effect, considering issues and outcomes which might previously not have been apparent. Thus there can be seen to be a clear educational aspect to apprenticeship training. With this identification, suitable strategies for teaching could be identified.

A Teaching Strategy for L7 MSc and Apprenticeship

The way in which educational and training ideas and concepts are combined will differ from subject to subject: a course focusing on executive-level strategic management will necessarily utilise different approaches to a course focusing upon the development of Artificial Intelligence, for example. For Systems Engineering (SE), the ethos is upon a highly reflective and analytical approach to problem identification and characterisation, developing requirements which can then aid the design and implementation of a suitable solution which can be utilised to solve the problem. This encompasses many aspects, including systems thinking about the problem space, development of stakeholder requirements and associated logical architecture, before potential solutions can be identified, evaluated, and down-selected. System requirements describe the required functionality and other factors pertaining to the chosen solution, and physical architecture and design then specify what is to be developed. At the same time, factors such as integration, verification, transition into service, validation and final acceptance are considered. The utilisation phase of the solutions lifecycle

is also mapped out, through until retirement and disposal. This process places a heavy emphasis upon the ability to conduct analysis and evaluation of a high quality, judgement, justification, and provision of evidence and rationale, all of which loan themselves to an education-focused approach. However, initial concepts such as completeness (holism), emergence, entropy, homeostasis, and viability can be discussed in a more structured manner utilising definitions and examples in context to convey meaning and understanding. In the same way, instruction can be provided on the nature, form, characteristics, and usage of different modelling techniques such as stakeholder identification, architecture frameworks, and modelling languages, and this can be achieved in a manner more akin to training. As such it can be seen that the two philosophies can be melded together, commencing with a training-based approach that evolves into a deeper, more questioning educational construct which satisfies both KSBs and broader ILOs. This 'middle way' enfranchising both apprentices and Masters-only students could employ the ideas expressed at table two below.

This idea can be potentially complex in nature and necessitates use of a flexible approach to learning within structured bounds that utilises methods of teaching and learning which both apprentices and masters-only students can relate to (Barker, 2021b). The approach settled upon must be seamless and integrated so that apprentices and students don't feel that certain elements of learning are not relevant to them, and it must also provide a structured learning experience which achieves the following:

- Cover essential topics, concepts and ideas which are essential to the understanding of systems engineering (SE) and which provide a holistic understanding of the subject in contexts which are both relatable and directly relevant to apprentices and MSc students
- Develop confidence in all areas of a cohort that they can achieve outcomes
- Gradually increase difficulty of learning objectives through a gradual process of step-by-step learning that first introduces key concepts before evolving toward advance practice with more testing challenges and assessments requiring a greater level of cognition, analysis, appraisal, and evaluation
- Be flexible enough to find the correct pace of learning whilst encouraging exploration of the subject area and development of analytical approaches which are underpinned by justification, appropriate evidence, and rationale to support evaluation and decision-making
- Use a range of teaching techniques and assessment types to stimulate and develop apprentices and students

The adoption of this approach was intended to strike a middle path which met the learning needs of both apprentices and MSc students whilst also satisfying expectations of other parties such as employers through combination of underpinning learning with student support and apprenticeship requirements in the form of tri-partite meetings, together with wider course activities such as student liaison committees.

Table 2: Potential Teaching Strategy for L7 MSc and Apprenticeship

	Andragogical device	Purpose
1.	Directed instructional sessions, podcasts, and/or demonstrations	- illustrate process and procedure - describe concepts and their meaning - describe modelling techniques and ideas, and how to use and apply them
2.	Discussions of domain or organisation-specific case studies	- place understanding in different organizational and enterprise-level contexts - illustrate use of different ideas, tools and techniques in context - Demonstration of applicability of systems engineering (SE) approach
3.	Package information into 'accessible chunks'	- Make information more comprehensible - Allow learners to study at their own rate - Allow apprentices to manage time budgets
4.	Use of guest speakers to add additional context	- Provide first-hand insight to benefits of SE - Illustrate use of ideas, tools and techniques in real-life context
5.	Provision of worked examples	- illustrate benefits of SE approach - provide basis of understanding through illustration of possible outcome - spark discussion and generate ideas
6.	Guided workshops	- generate knowledge and expertise - allow application of SE ideas and techniques to a relevant real-life or work-based context
7.	A range of formative and summative assessment approaches	- test different aspects of learning and understanding - test ability to apply SE appropriately and in context
8.	A mix of individual and group tasks	- Facilitate development of independent learning - Promote group work and learning - Allow dissemination of knowledge and experience through the cohort
9.	Provision of targeted support for all students	- Support apprentices and MSc students through their learning journey - tailor learning to individual needs - allow, within bounds, people to learn at their own pace

Feedback on Teaching Strategy From Stakeholders

Following identification of the potential teaching strategy described at table two, the concept was refined using input from members of the course team, the university office responsible for apprenticeship experience and progression, and student support services. Feedback from previous cohorts of students was also factored in, as was information on the needs of employers and industry taken from the course's Industrial Advisory Board (IAB). The blend of training and education techniques incorporated in the resulting approach met with a favourable response, with feedback showing that it provided the intended initial gradual learning curve to first instill the essential concepts and techniques of SE before building to cover more complex ideas and necessitating a greater degree of self-driven learning, reflection and evaluation. In particular, feedback from apprentices, and MSc students,

suggested that the chosen andragogical teaching strategy afforded them the following benefits:

- Clear instruction and provision of information
- Time to understand and apply ideas and techniques in a structured way
- An approach which built confidence in understanding by introducing ideas gradually and in a logical, understandable framework
- relevance of material to their own experience
- the ability to specialise learning through taking elective modules linked to apprentice/student areas of interest or specialism
- a supportive learning environment through provision of individual mentors, an apprenticeship tutor, student support services, and a thesis supervisor

This broadly positive feedback allowed further refinement to the course, utilising recommendations to achieve improvements such as an increased use of technology, addition of module content relevant to apprentices and MSc students, and to further develop methods of individual support for individuals on their learning journey.

Feedback from employers was also sought through regular apprentice tri-partite meetings, and also through the IAB. The employers stressed the importance of structured review, demonstration of progress, and development of applicable skills, knowledge and expertise, and their comments suggested that the course and it's teaching strategy was viewed as:

- Providing a structured and learning programme
- Mapping well in terms of content and subject matter to industrial need
- Allowing apprentices to progress well toward their EPA

This process of feedback and review needs to be continuous, but results were deemed positive, and in addition there was review internally to the course team and student support teams to identify improvements that could be realised. This highlighted the need to tailor support for different individuals and cohort mixes, continue to develop suitably flexible teaching strategies and approaches, to learn from apprentices' views of industry and to potentially develop closer links with industry as a result. This continual review also highlighted the need for continual review and 'flexible adaptation' of the course offering to maintain a pace with the changing nature and latest developments in the field of SE.

Conclusions and Lessons Learned

It is important to acknowledge that development and delivery of a course, especially where an existing course structure is being modified and revised to incorporate new ideas and structural needs in the form of an apprenticeship, is a learning experience not just for those who study on the course, but also for those who develop, deliver, and support it. Among the key lessons to be learned from this were the need for continual and clear communication in the following aspects:

- Clarity of information provided to learners, and points during the course at which information should be provided
- Linked to the above point, the provision of a clear roadmap detailing structure of the course, path to attainment of intended qualification, and processes by which the course will operate
- Clarity in how students can access support and the procedure that needs to be followed

- Communication between course, administration, and support teams to provide clarity and seamless course delivery
- Consultation with employers and industry; the field of SE is rapidly evolving, and it is essential to understand which elements are most relevant and valued by industry

Among other important conclusions from this process were that the andragogical teaching strategy needs to be both multi-faceted and capable of change as required because of the following factors:

- No two cohorts of apprentices and masters-only students are necessarily similar
- Different learners need support in different ways
- Different types of learners can spur development of teaching ideas in different ways, evolving ideas around different techniques and approaches to how they might be employed to support the learning journey

The necessity to stay current with needs and requirements of industry, and the potentially increased opportunity to consult with industry were also key outputs from the process as identified in the above lessons learned. This generated ideas for future work, which centred around the need to continue to develop the 'flexible teaching strategy' to adapt to and support learner's needs whilst also keeping pace with developments in the field of SE and remain relevant to employer and industry needs. There is also the need to ensure regular student and employer-facing review meetings, and to seek on an ongoing basis new methods of enhancing and developing the course and its delivery.

Notes

DAS: No new data was created or analysed in this study. Data sharing is not applicable to this article.

References

Allen, K. (2016). "Apprenticeship levy will go ahead next year, government confirms": https://www.theguardian.com/education/2016/aug/12/apprenticeships-levy-will-go-ahead-next-year-uk-government-confirms, The Guardian, August 12th 2016.

Armstrong, P. (2010). Bloom's taxonomy. *Vanderbilt University Center for Teaching*, 1-3.

Barker, S. G., (2014). *Post Graduate Certificate in Learning, Teaching and Assessment in Higher Education.* Cranfield University.

Barker S. G. (2021a). Supporting students in a changing educational climate: A systems engineering case study. In: *13th Asian Conference on Education (ACE2021)*. 25-28 November 2021. Tokyo, Japan.

Barker, S. G. (2021b). Complexity and the art of education: A study of how to approach teaching more challenging engineering systems development concepts. *IAFOR 2nd Barcelona Conference on Education*. 8th – 10th December 2021. Barcelona, Spain.

Barker, S. G. & Smith, J. D. (2021). Altered Andragogy: Lessons from Lockdown for Systems Engineering Education. *IAFOR 9th European Conference on Education.* 15th-18th July 2021. London.

DoE. (1971). "Glossary of Training Terms", Department of Employment, HM Government.

Doughty, R. (2018). "From Barclays to Boots, apprenticeships are transforming management training": https://www.theguardian.com/education/2018/mar/06/from-barclays-to-boots-apprenticeships-are-transforming-management-training, The Guardian, March 6th 2018.

Goldstein, I. L. (1980). Training in work organizations. *Annual Review of Psychology,* vol. 31, pp. 229-272.

IfATE. (2024). "Apprenticeship Standards": https://www.instituteforapprenticeships.org/apprenticeship-standards/

Kant. (1997). "Critique of Practical Reason", Cambridge University Press; New Ed. ISBN: 0521599628.

OfS. (2024). "Degree apprenticeships - guide for apprentices: What are the benefits?": https://www.officeforstudents.org.uk/for-students/planning-to-study/degree-apprenticeships-guide-for-apprentices/what-are-the-benefits/#:~:text=You%20will%20learn%20skills%20that,Your%20prospects%20are%20good

Plato. ([c475BC] 2007). "Republic", Penguin Classics; 3rd edition

Queen Mary Academy. (2024). "Knowledge, Skills and Behaviours": https://www.qmul.ac.uk/queenmaryacademy/educators/resources/degree-apprenticeships/curriculum-design/ksb/

THE. (2018). “Degree apprenticeships are quietly revolutionising higher education”: https://www.timeshighereducation.com/blog/degree-apprenticeships-are-quietly-revolutionising-higher-education

UK Government. (2015). “Government rolls-out flagship Degree Apprenticeships”: https://www.gov.uk/government/news/government-rolls-out-flagship-degree-apprenticeships

UK Government. (2016). “Apprenticeship technical funding guide”: https://www.gov.uk/government/publications/apprenticeship-technical-funding-guide

UK Government. (2018a). “Apprenticeship Funding”: https://www.gov.uk/government/publicaUK Government (2024tions/apprenticeship-funding, Department for Education

UK Government. (2018b). “Greater flexibility for apprenticeship levy as transfers extended”: https://www.gov.uk/government/news/greater-flexibility-for-apprenticeship-levy-as-transfers-extended, Department for Education

UK Government. (2024a). “What qualification levels mean”: https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels

UK Government. (2024b). “End-point assessment guide for apprentices”: https://www.gov.uk/government/publications/end-point-assessment-guide-for-apprentices-2024/end-point-assessment-guide-for-apprentices

University of Strathclyde. (2024). “Key Benefits of Apprenticeship Degrees”, https://www.strath.ac.uk/studywithus/apprenticeshipdegreesatstrathclyde/blogs/keybenefitsofapprenticeshipdegrees/