

Applicability of non-modular assessment in construction management and allied undergraduate programmes - Perspective of the academics involved

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Abstract

Undergraduate programmes on construction management and other closely related built environment disciplines are currently taught and assessed on a modular basis. This is the case in the UK and in many other countries globally. However, it can be argued that professionally oriented programmes like these are better assessed on a non-modular basis, in order to produce graduates who can apply knowledge on different subject contents in cohesion to solve complex practical scenarios in their work environments. The examples of medical programmes where students are assessed on a non-modular basis can be cited as areas where this is already being done. A preliminary study was undertaken to explore the applicability of non-modular assessment within construction management undergraduate education. A selected sample of university academics was interviewed to gather their perspectives on applicability of non-modular assessment. General acceptance was observed among the academics involved that integrating non-modular assessment is applicable and will be beneficial. All academics stated that at least some form of non-modular assessment as being currently used in their programmes. Examples where cross-modular knowledge is assessed included comprehensive/multi-disciplinary project modules and creating larger modules to amalgamate a number of related subject areas. As opposed to a complete shift from modular to non-modular, an approach where non-modular assessment is integrated and its use further expanded within the current system is therefore suggested. This is due to the potential benefits associated with this form of assessment to professionally aligned built environment programmes.

Keywords: Assessment, Built environment, Construction Management, Non-modular assessment

1. Background

In the UK, most of the undergraduate programmes are completely delivered and assessed in a modular form. A modular assessment is one in which the content is divided into a number of units or modules, each of which is assessed separately (Rodeiro and Nádas 2010). However, in some fields of study, students are assessed on a non-modular basis at least up to a certain extent. At the undergraduate (UG) level, these seem to be core professional programmes such as medical and pharmaceutical studies. The UK universities seem to still employ non-modular assessment within postgraduate study programmes to a higher extent than in UG programmes. Leask (2014) identified over assessment and the extent of work load students have to undertake within modular assessment as key issues that favour non-modular assessment. It was also noted that non-modular programmes could lead to better student/staff relationships (Leask 2014).

UG programmes in construction management (and other related programmes such as quantity surveying, building surveying, facilities management) too are currently being delivered and assessed on a modular basis. However, it may be argued that introducing non-modular assessment; at least partially, may benefit a professionally aligned study programme such as construction management, where the knowledge of students can be assessed across different modules. Similar to other fields of study, factors such as over assessment provide the basis for the debate as to whether the method can be re-introduced to construction management curriculum. Opportunity provided by non-modular assessment to assess the ability of students to apply subject matter delivered in separate modules to solve real-life scenarios where cross-modular knowledge is required provides an even stronger basis for the argument. The method is adopted in higher degrees such as professional doctorates in the built environment currently. However, its use in UG programmes has been limited, since the universities have shifted towards modular delivery and assessment in the recent decades. The research is developed to explore the applicability of non-modular assessment in construction management UG programmes. There is limited discourse in the literature and research contextualising application of non-modular assessment within built environment UG programmes.

To a certain extent, universities now attempt to assess students that undertake construction management and allied programmes for their cross-module knowledge and understanding through a separate module. This is being achieved through a module where students have to design and plan a project for a given (real or hypothetical) scenario. However, this is done in addition to regular module assessments. Further, its primary objective is to provide students with an understanding on roles and responsibilities of different professions involved in designing a construction project and develop their ability to work together as a team. The study investigates the possibility of adopting non-modular assessment to an even greater extent within construction management and allied programmes. It seeks to explore this issue by reviewing literature and undertaking qualitatively assessing the views of academics involved in delivering construction management UG programmes.

2. Aim and objectives of the study

Accordingly, the aim of the study was to explore whether non-modular assessment can be adopted as an effective assessment technique in construction management UG programmes. The objectives of the study were;

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- To assess pros and cons of adopting non-modular assessment in construction management and allied undergraduate programmes
- To investigate the applicability of non-modular assessment within current construction management curriculum.
- To identify issues that may arise and will have to be addressed if the technique is to be adopted.
- To determine and recommend whether to and if so, how to, adopt non-modular assessment in construction management UG programmes.

The study seeks to explore the above from the perspective of academics involved in designing and delivering construction management programmes. Whilst a comprehensive study will benefit from gathering the perspectives of diverse stakeholders such as the industry, professional institutes, universities, and students; this phase of the study is limited to exploring the perspectives of academics involved.

3. Modular and non-modular assessments

Modular assessment is where the content is divided into a number of units or modules, each of which is assessed separately (Rodeiro and Nádas 2010). This is facilitated by modular programme delivery which is widespread and is the common practice across higher education institutes in the UK and worldwide. Developed in 1970s, modular curriculum is considered as an important innovative development in education (Carr 2003). It has since become increasingly popular and adapted worldwide, as it was thought that modular programme delivery offers flexibility and choice for students, reduces the cost of delivery, enable student numbers to be expanded and enable centrally administered structures of regulation (Booth et al. 2000). When these modules are assessed separately, modular assessment occurs. Rodeiro and Nádas (2010) though a detailed review of literature identified issues such as the ability to spread assessments over the term/year, ability to re-take a module rather than the entire assessment, making it easy for students to prepare for assessment and manage time effectively, and ease of revision as some of the advantages associated with modular assessment.

However, modular programme delivery and assessment is not without criticism. For instance, in the same study mentioned above, Rodeiro and Nádas (2010) also identified a range of disadvantages of modular assessment. It was identified issues such as; danger of fragmentation of learning and lack of coherence in learning programmes, poorly developed overview of subjects, inability to connect discrete areas of knowledge, adversely affecting the coherence of a programme, possibility of assessment rather than learning taking the centre stage, and over-assessment as some of the key drawbacks of modular assessment. Similar views have been shared by other researchers; for e.g. Cox and King (2006) found disadvantages such as students not forming coherent groups progressing together for the duration of the course, difficulty to track students' progress as each student can have their own individual programmes of study, and various module combinations confusing employers as to what subjects have been studied. Leask (2014) identified over-assessment as one of the key issues associated with modular assessment in UG programmes. 'Bunching' of assessments, where assessments are concentrated around the mid and later stages of a term/year was also identified as a key issue (Leask 2014).

Due to these issues, approaches where modular assessment is complemented by non-modular assessment within a programme or where courses are being offered on a completely non-modular basis has been introduced by higher education institutes. Non-modular professional doctorate programmes (Frame 2013), and non-modular postgraduate taught and research programmes are some examples. At the UG level, non-modular UG programmes offered by the Faculty of Medicine, Dentistry and Health at the University of Sheffield, by the School of Social and Community Medicine at University of Bristol, and by the School of Medicine at Cardiff University can be cited as some examples of UG programmes delivered completely on a non-modular basis. Additionally, there are many examples where non-modular and modular assessments are used complementary to each other at the UG level by UK universities.

The salient feature of non-modular programmes offered at the UG level seems to be that they are often courses related to medicine and allied professions where complete and coherent knowledge and expertise in the subject content is required to be skilled practitioners. This would require them to be able to link subject content learned progressively and apply coherently rather than in isolation; whereas the lives of patients could be at risk if this is not to be the case. Hence, such professional disciplines seem to favour non-modular assessment. Whilst it may be argued that a similar level of professional expertise is not required by CM graduates, perhaps a similar level of professional expertise should be expected of CM graduates as the clients, employers, and the society in general rely on their professional judgment and practice.

4. Non-modular assessment in construction undergraduate programmes

4.1. Nature of construction higher education

Higher education institutes that produce CM graduates cater for an important sector in any economy. For e.g. in the UK, the industry contributes to over 7% of the gross domestic product, and account for over £110billion of economic activity (Cabinet Office 2011). Accordingly, the government recognises that a successful construction industry is vital for sustainable growth, as the industry is responsible for the delivery and maintenance of residential and commercial properties, and economic and social infrastructure that support the whole economy of the country (HM Treasury 2011). CM graduates are expected to play a key role in this significantly important industry sector. Being professionally oriented programmes, UG programmes are therefore required to cater for the industry requirements. For instance, as the industry is characterised by its fragmented and adversarial nature, it is continuously being encouraged to develop collaborative working (Latham 1994, Egan 1998, Cabinet Office 2011). Therefore, HE institutes are being required to develop graduates with the ability to collaboratively work with stakeholders involved. This requirement; the need for developing graduates with the ability to engage in effective cross-disciplinary teamwork with other industry professionals, was highlighted by Nicol and Pilling (2005). However, universities have long been criticised for not covering the subject matter that the industry requires (Oglesby 1983). Specially, the HE sector has been found slow to respond to emerging trends; for e.g. to address issues related to flood adaptation and disaster risk reduction within their UG programmes (Wedawatta, Ingirige, and Proverbs 2012). Although such criticisms exist, it is clear that the industry requirements play a prominent role in determining the direction of UG programmes in CM.

Further, as Durning and Jenkins (2005) noted, the links with professional bodies significantly shape the relationships for students and for staff in CM higher education. Most programmes are accredited by professional institutes such as the Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Building (CIOB). For instance, Aston's undergraduate programme in Construction Project Management is accredited by both these professional institutes. Therefore, the curriculum is determined by the accreditation frameworks of these professional institutes to some extent. For e.g, The CIOB Education Framework is required to be followed when applying for CIOB accreditation/ re-accreditation and to inform programme design or review in CM education (CIOB 2013).

Chynoweth (2009) discussed built environment as an applied, but theoretically coherent, inter-discipline. further, according to Gajendran et al (2014), construction manager's role in project-based organisations is dominated by complexity, uncertainty and interconnectivity. This inherent nature of construction industry, projects and organisations, and their operation within uncertain and dynamic socio-cultural-political environments, poses considerable difficulties in understanding and working in construction project organisations. Therefore, it was concluded that such an operating environment demands CM graduates who can have knowledge, skills and attitudes to operate in turbulent environments (Gajendran et al. 2014).

Summating these features, the subject benchmark statement for construction UG programmes (The Quality Assurance Agency for Higher Education 2008) identified a range of issues related to the nature of construction UG education. It was noted that students are required to acquire the subject-specific skills that enable them to work effectively within their field along with the development of generic, cognitive skills which they will be able to apply within their academic and work contexts upon graduation (The Quality Assurance Agency for Higher Education 2008). The students on construction UG programmes too have highly valued practice-relevant, hands-on learning, where references are made to tangible and real situations (Frank 2005). It therefore is essential that these skills and competencies are instilled among CM graduates through learning and assessment.

4.2. Assessment in construction undergraduate programmes

Given that construction is a discipline that links theoretical, practical and professional competencies, pedagogy adopted is encouraged to embrace practical application of theory and include a variety of assessment methods (The Quality Assurance Agency for Higher Education 2008). There also seems to be a lot of emphasis on including both formative and summative assessment within the CM UG programmes (Construction Industry Council 2005, CIOB 2013, The Quality Assurance Agency for Higher Education 2008, Perera and Pearson 2013). In general, UG programmes in construction seem to follow a modular structure in delivery of learning content and their assessment. Within this overall structure though, HE institutes seem to employ a variety of assessment methods as encouraged by the Quality Assurance Agency for Higher Education.

One of the key issues associated with modular learning and assessment in construction UG programmes seems to be the lack of coherence; assessing students for their ability to connect specific subject content learned within different modules in order to solve complex problems. For example, Chynoweth (2009) in his research found that law related modules are rarely integrated with other subjects and law subjects were delivered and assessed exclusively within their module. It was noted that a wider interdisciplinary model where a common built environment curriculum integrating all the subject domains; for e.g. technology, management,

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law etc as being required. Although the subject benchmark statement for construction programmes (The Quality Assurance Agency for Higher Education 2008) recognises the multi-disciplinary and applied nature of CM education and the need for producing graduates with cognitive abilities and the ability to apply their learning in practical settings, it falls short of specifically calling for assessing student knowledge and understanding comprehensibly rather than in isolation within specific modules.

Further, CM programmes are often attributed with over-assessment. The researcher has observed during his time at 3 UK universities that CM UG programmes offered by HE institutes often tend to over-assess students. Over-assessment in CM UG programmes have been reported by other academics as well (Higgins, Grant, and Thompson 2010, Scott and Fortune 2013). Further, although it was found comparable to the levels reported in previous research using non-construction student samples, Lingard et al (2007) found that burnout as a phenomenon experienced by CM UG students. Whilst assessment load was not a variable studied therein, over-assessment could well be associated with this phenomenon.

4.3. Applicability non-modular assessment in construction undergraduate programmes

The rationale for inclusion of some sort of non-modular assessment in CM UG programmes is based on the issues discussed above in the previous sections (Sections 4.1 and 4.2). As discussed in the Section 3 above, modular assessment is associated with drawbacks such as danger of fragmentation of learning and lack of coherence in learning programmes, poorly developed overview of subjects, inability to connect discrete areas of knowledge, and adversely affecting the coherence of a programme (Rodeiro and Nádas 2010). Such drawbacks could be particularly damaging for professionally aligned UG programmes similar to CM.

Similarly, the RICS also requires the graduates to have the ability to apply the theory in practice (RICS 2014). What this highlights is that the industry and the professional bodies require the graduates to be able to apply what they learn in practice. Further, as noted by Lee et al (2011), changing nature of social, economic, and environmental issues related to CM drives CM programs to produce more prepared personnel. Furthermore, CM professionals are expected to be competent problem-solvers in construction projects and organisations. This would require them to apply different subjects learned separately at the university in coherence to solve problems and make decisions. Such cognition skills need to be instilled among CM UG students during their studies. It can be argued that at least a certain degree of non-modular assessment is required within CM UG programmes to achieve these objectives.

Considering the need for problem-solving skills by integrating content learned in different modules, universities have attempted to introduce assessment which assesses the knowledge and understanding of students across different modules and subject content learned progressively. One such development is the use of a separate integrated project module, where students from different subject backgrounds will come together or will play the role of different professional members in a project team to develop a comprehensive solution to a real or hypothetical scenario. As noted by Wood (1999), such assessments act as a method of fostering collaboration, enable students to experience working together and encourage them to appreciate the abilities and roles of others, as well as putting their own specialism into context. Therefore, it is inevitable that students will benefit from more assessment similar to this where knowledge across modules is assessed, either via non-modular assessment or having separate modules for this purpose (which in this study is identified as a form of non-

modular assessment due to the fundamental arguments behind their introduction being similar to that of introducing non-modular assessment discussed here).

Further, Scott and Fortune (2013) noted that students find it difficult to benefit from receiving feedback as students found the comments given related only to a specific module. This suggests that students would benefit from an approach where feedback is provided by making connections to other modules; i.e. cutting across modules. In practice, this would be possible if non-modular assessment is included within UG programmes.

Frame (2013) demonstrated the ability to design and operate a non-modular programme at the doctoral level to meet the needs of professionals working in construction. Whilst the programme in concern there was a doctoral programme, this suggests the applicability and suitability of non-modular learning and assessment in built environment/ construction management higher education.

A further justification would be how this type of delivery and assessment is being used in medical and allied UG programmes as mentioned in Section 3. It can be argued that as professionally aligned programmes that seek to deliver competent professionals to the construction industry, a similar standard of expertise should be expected from CM graduates. The decisions and actions of the CM graduates have significant and far reaching effects in many fronts; including the organisations that employ them (for e.g. in terms of financial, reputational, legal), people working for and with them (for e.g. health and safety, personal wellbeing), government and local authorities (e.g. rules and regulations, government strategy), as well as the society in general (e.g. sustainability, climate change, health and safety).

5. Research method

5.1. Research design

Whilst it is not intended to discuss the philosophical positioning of the study in detail, it is intended to briefly state the philosophical stance adopted in order to clarify the methods adopted. The research was positioned as that of the philosophical positioning of an interpretivist. Interpretivism is an epistemology that advocates that it is necessary for the researcher to understand the differences between humans in their role as social actors and to emphasise those differences when conducting research among people rather than objects (Saunders et al, 2009). The nature of research questions involved in the study favoured this philosophical positioning.

Extent to which a researcher is clear about the theory at the beginning of the research raises important questions about the research design and which research approach will be employed (Saunders, Lewis, and Thornhill 2009). Two approached that can be undertaken therein are deduction (testing theory) and induction (building theory). Deductive approach is where the researcher develops a theory and hypothesis and designs a research strategy to test the hypothesis. Inductive approach is in which the researcher collects data and develops theory based on data analysis. According to Collis and Hussey (2009), inductive study is “a study in which theory is developed from the observation of empirical reality; thus, general inferences are induced from particular instances”. Given that the study sought to investigate the views of academics involved in construction management UG programmes, and arrive at answers to

the research questions, it was thought that the inductive approach it best suited to undertake the study.

Philosophical positioning and the research approach favoured a qualitative research design to be adopted. Qualitative research, according to Creswell (2003), is “one in which the researcher often makes knowledge claims based primarily on constructivist (which is closely aligned with interpretivism) perspectives, or advocacy/participatory perspectives or both”. Under the qualitative approach the researcher, according to Creswell, collects open-ended, emerging data and develops themes from the data collected. Given that this research was undertaken as an exploratory study, qualitative research approach was selected as best suited to achieve the expected aim and objectives. Within this, semi-structured interviews will be conducted to collect information from the research participants.

5.2. Data collection method

Bryman and Cassell (2009) identified interviews as probably the most widely utilised method in qualitative research. Interviewing is a method for collecting data in which selected participants are questioned in order to find out what they do, think or feel (Collis and Hussey 2009). Semi-structured interviews allow collection of specific information from participants whilst maintaining a consistent line of inquiry. Short telephone interviews were conducted over the phone with the selected participants to gather their views and opinions. A similar research design was used by Wood (1999) to explore the attitudes among CM academics to introducing interdisciplinary working within built environment education, suggesting the suitability of the method for this research. **Ethical approval was obtained from Aston University prior to execution of the data collection process and informed consent was obtained from the participants.**

5.3. Sample

Informants involved in the study were academics; lecturers / senior lecturers / programme directors, involved in the design and delivery of construction management and allied UG programmes (for e.g. quantity surveying) in the UK universities. Access was sought through the personal connections that the researcher has with academics from the UK universities that deliver these programmes.

Purposive sampling technique was adopted for selecting and recruiting universities and academics for the study. According to Saunders et al (2009), purposive sampling enables a researcher to use his/her own judgement in selecting cases in a way that best enables the researcher to answer the research questions and accomplish the research objectives. Yin (2011) commented that purposive sampling was likely to be used in qualitative research where samples are selected in a deliberate manner. Yin (2011) highlighted that the reasoning behind the use of purposive sampling was to select the cases that could provide the most relevant and rich data. Sample of academics selected for the study sought to achieve a balance of participants in terms of their role in programme design and delivery, assessment design and delivery, level of experience, and the standing of the university that they are working for. Accordingly, short telephone interviews were conducted with the selected sample.

The table below presents the sample of participants involved in the study. Accordingly, academics from 9 UK universities that offer CM and allied programmes were interviewed for the study – **out of an original sample of 10**. The sample consisted of academics with

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significant teaching experience in a HE setting to early-career academics who have been involved with teaching and assessment for a few years. Whilst some universities (for e.g. U5 and U6) only offered a single CM UG programme, other universities involved offered a number of related programmes.

Table 1 - Details of the interview sample

University	Academic	Position	Programmes delivered at the University
U1	U1A	Lecturer	Construction Management, Quantity Surveying, Building Surveying
U2	U2A	Senior lecturer / Programme director	Construction Management, Construction Project Management, Quantity Surveying
U2	U2B	Senior lecturer	Construction Management, Construction Project Management, Quantity Surveying
U3	U3A	Lecturer	Construction Project Management, Quantity Surveying
U4	U4A	Senior lecturer	Construction Management, Construction Project Management, Quantity Surveying, Facilities Management
U5	U5A	Lecturer	Construction Management
U6	U6A	Lecturer	Construction Project Management
U7	U7A	Senior lecturer / Programme director	Construction Management, Construction Project Management, Quantity Surveying
U8	U8A	Lecturer	Quantity Surveying, Building Surveying
U9	U9A	Lecturer	Construction Engineering Management, Commercial Management and Quantity Surveying

5.4. Data analysis

Data collected from the interviews were analysed using content analysis. According to Easterby-Smith et al (2008), content analysis is a technique in which the researcher interrogates data for constructs and ideas that have been decided in advance. Krippendorff (2004) identified that content analysis can take the form of word count or be thematic,

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conceptual. In this study, conceptual content analysis is used to analyse interview data. In conceptual content analysis the text is scrutinised to check the existence of a concept, considering terms related to the concept both implicitly and explicitly (Krippendorff, 2004). Conceptual content analysis was adopted in this study. Therefore, as opposed to numerical count or frequencies, importance was placed on the views expressed by the interviewees irrespective of the number of times the issue being mentioned. Considering the sample size, this method allowed capturing a wide spectrum of issues raised by the participants.

6. Findings and Analysis

The interviews with the academics involved in designing and delivering CM UG programmes in the UK universities addressed the issues of; applicability of non-modular assessment in UG programmes in CM, whether and how it is being currently applied in their institutes, opportunities to further expand its application, potential benefits, and barriers to implement and how to overcome such barriers. Following sections presents and discusses the findings from the interviews.

6.1. Applicability of non-modular assessment in CM UG programmes

In general, the academics interviewed were in agreement that non-modular assessment is applicable in CM UG programmes. The main reason cited by the academics for its applicability was the ability to provide a cross-disciplinary knowledge and understanding to students, enabling them to obtain a better overall understanding. This is consistent with the rationale behind this study, as discussed previously.

I'm supportive of using non-modular assessment for progressive knowledge development that will help students – U2A

Non-modular assessment is quite essential and beneficial form of assessment within undergraduate construction programmes given that construction is a multi-professional effort; and application of knowledge during construction requires cross-disciplinary understanding and understanding across-modules – U3A

In a way non-modular assessments provide a greater opportunity for students to articulate everything in a single bit which of course help them to foresee the big picture of their programme – U4A

Non-modular assessment methods are vital in order to ensure that student meet all module learning outcomes – U5A

However, it was also noted that caution has to be exercised when introducing / using non-modular assessment within the current HE and institutional settings. One academic noted that the method will only be effective in some areas, whereas modular assessment will be beneficial in other cases. There was agreement that switching to a complete non-modular assessment framework would not be applicable or practicable. It was recognised that a opting for a combination of modular and non-modular assessment as a better way achieving learning outcomes and producing industry-oriented graduates.

It would be dangerous to use only non-modular assessment as construction programmes should cover theory and practices in different domains. However it would be good to mix

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up with modular and non-modular assessment so that student would have a chance to be assessed in a balanced manner – U6A

A combination of modular & non-modular will be good. It allows the essential element of integration to be achieved within the programmes – U8A

6.2. Benefits of non-modular assessment to CM programmes

Views of the academics were gathered on potential benefits of using non-modular assessment within CM UG programmes. The views expressed are summarised in the Table 2 below; based on students, academics and the industry.

Table 2 – Benefits of integrating non-modular assessment in CM UG programmes

Students	Academics / Universities	Industry	Other
<ul style="list-style-type: none"> • Reduced assessment load • Less pressure on students • Improved quality of assessments • Progressive knowledge development • Opportunities for collaborative working • Learn key principles of team working • Familiarise with the roles and responsibilities with other construction professionals • Learn and understand where and how their knowledge, skills and expertise could form part of the entire collaborative 	<ul style="list-style-type: none"> • Ability to assess student knowledge on the whole component rather than in parts • Ability to provide a better coherent picture • Less marking load • Increased graduate employment rates • Increased value of UG programmes in the industry • Better NSS score 	<ul style="list-style-type: none"> • Opportunities to get more involved with UG programmes • Help the industry to establish strong links with the academia • Identify deficiencies in student skills and knowledge in real-life scenarios • Receive innovative, creative-thinkers as graduates • Graduates who will require less time to adapt to working conditions • Graduates with multi-disciplinary, problem-solving skills • Less risk in hiring fresh graduates • Resolve the industry fragmentation in terms of disciplines, knowledge, people 	<ul style="list-style-type: none"> • Opportunity to re-visit APC assessment criteria

effort <ul style="list-style-type: none"> • Improved practical application skills • Greater confidence • Avoid fragmentation in learning 			
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Analysis of the potential benefits identified by the academics demonstrates that many of the benefits will be for students and the industry. These benefits are mainly associated with students being able to receive a practically-relevant coherent learning experience which will enable them to collaborate effectively within the project team. The industry on the other hand will benefit from graduates with problem-solving skills and multi-disciplinary knowledge and understanding who will be able to quickly adapt to working conditions and contribute effectively to the construction team. Therefore, there seems good justification to integrate non-modular assessment within CM UG programmes, as clear benefits can be expected.

6.3. Current use of non-modular assessment in CM programmes

All academics stated that at least some form of non-modular assessment as being currently used in UG programmes. Examples where non-modular assessment is included or where students are assessed across modules included individual / group case studies, group presentations, virtual models, scenario based assignments, and role-plays. Academics specifically recognised that the objective of providing a cross-disciplinary understanding is currently being achieved though the inclusion of a separate module(s) which seek to achieve this learning objective. The examples noted were;

- Integrated project module / Multi-disciplinary project module
- Professional practice module / Integrated professional practice module
- Final year dissertation module

No examples of modules being assessed together (for e.g. construction technology and measurement delivered separately, but assessed together) were noted. However, instances where modules have been combined and allocated a higher credit load (double or triple, based on how many modules are brought together) to create super modules were noted. This actually suggests that non-modular assessment has been integrated to the existing modular system in CM UG programmes in some of the universities included in the study.

The academics recognised the relevance and the need for assessing the students for their cross-disciplinary knowledge and understanding. Whilst no programmes involved in the study are currently being delivered in a completely non-modular basis, it was also recognised that a complete shift from the current system would not be ideal. Rather a system where traditional modules have been combined to create super modules, introduce separate modules to bring together different subject domains, and assessing students for their cross-disciplinary knowledge via different formative assessment methods seems to be the current approach undertaken.

6.4. Potential for further application

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Academics were questioned whether there is potential to further apply non-modular assessment within CM UG programmes. Many academics considered that there is potential to further apply this method of assessment within CM programmes.

Yes, some modules need knowledge and understanding from previous or concurrent modules, which can be easily grouped together during summative assessments – U1A

Especially, it was mentioned that new developments related to construction like Building Information Modelling (BIM) will present more opportunities towards this. This is due to the fact that BIM makes it possible to bring different subject domains together; for e.g. drawing and CAD, measurement, scheduling, cost estimating etc.

Yes, with the introduction of Building Information Modelling there will be more opportunities to use non-modular assessment within the UG programmes to a considerably high extent – U4A

Yes of course, for e.g. more simulated professional practice; research driven teaching – U8A

Further, it was also noted that expanding the use of non-modular assessment should be carefully assessed to ensure that learning outcomes are properly achieved.

It is more about achieving a balance between modular knowledge driven sections and practice based cross-modular, inter-disciplinary requirements – U7A

The need for achieving a balance between the two types was again highlighted. One academic viewed that a complete revamp of the course structure will be required if more non-modular assessment to be included. In general, there was acceptance that a complete revamp will not be desirable, but to integrate non-modular assessment within the current modular structure.

6.5. Challenges for further application and way forward

Views expressed by academics on barriers for including / further expanding application of non-modular assessment is categorised in to 4 groups; student related, staff related, programme/institute related, and external, for ease of analysis. Table 3 summarises the views expressed by the academics under these 4 categories. Given that it was difficult to attribute resistance to change and the challenge of convincing all stakeholders involved to a particular group(s), these were included in the table as factors related to all groups in general.

Some of the issues expressed can in fact be identified as drawbacks of including non-modular assessment; for. E.g. difficulties in planning and managing modules, additional work on academics, lack of flexibility for students. There were concerns that additional non-modular assessment and the resultant combined work load, difficulty in spreading out assessments, and difficulties in providing options subjects may not be preferred by the students. There was also recognition that the approach will put more workload on academics. It was noted that setting appropriate assessments, marking and providing detailed feedback will become difficult. There was also recognition that more non-modular assessment will require additional resources, will create operational and planning difficulties, and will require changes to current programme and assessment structures. It was noted that if cross-modular assessment such integrated projects to be increased, it will require more involvement of the industry. Lack of

industry involvement was therefore identified as a barrier towards expanding such cross-modular assessment. Accordingly, if non-modular and cross-disciplinary assessment is to be enhanced, these barriers will have to be addressed.

Table 3 – challenges for integrating / further expanding application of non-modular assessment

Student related	Staff related	Programme / Institute related	External
<ul style="list-style-type: none"> • Student expectations • Difficulties in managing student work load • Student demand for structured and spread-out assessment points • May not always allow students to pick & choose subjects; low flexibility 	<ul style="list-style-type: none"> • Difficulties in marking and providing feedback • Academics' lack of industry practice/experience • Issues related to setting an appropriate assessment • Additional workload on academics • Difficulties in managing the pace of student's work and learning 	<ul style="list-style-type: none"> • Difficulty in planning and managing modules • Operational issues including staff timing, appropriate facilities, time tabling • High resource requirement • Current programme & assessment structures • Difficulty to cover all the necessary knowledge and skills • Relevance and inter-connection between some subjects, concepts and principles • Could act as a barrier to sharing modules across programmes 	<ul style="list-style-type: none"> • Lack of industry involvement
<ul style="list-style-type: none"> • Resistance to change • Convincing the stakeholders involved 			

Suggestions by the academics interviewed to overcome the difficulties posed by non-modular assessment are also grouped under the classification adopted above to present the barriers/difficulties. Table 4 presents the suggestions made by the academics in this regard. Accordingly, it can be seen that many of the improvements are related to curriculum design and capacity of academics. It was highlighted that the academics will have to venture beyond their specialist subject domains and expand their knowledgebase and their practical understanding if non-modular assessment to be increased. It was also recognised that cooperation among academic staff will be required to make the approach a success, as it was accepted that many academics will not be/will hesitate to deliver super modules spanning across different subject domains on their own. To address this competency requirement, there was a suggestion for universities to develop more multi-disciplinary lecturers. These

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comments suggest the need for capacity building of academics in terms of their knowledge and understanding as well as team working if non-modular assessment is to be increased. The other major suggestions for improvements included issues around curriculum design and development. Importance of obtaining comments and feedback from internal and external stakeholders including the industry, professional institutions were cited as important if barriers to be overcome.

Table 4 – Suggestions to overcome challenges

Student related	Staff related	Programme / Institute related	External
<ul style="list-style-type: none"> • Clear communication of assessment criteria and the purpose/benefits of non-modular assessment 	<ul style="list-style-type: none"> • Improving practical knowledge of academics • Improving the involvement of academics in non-modular assessment • Integrating past knowledge/aspects taught in previous modules within the current assignments/reports etc. • Cooperation with other colleagues would be necessary as one lecturer would not be able to cover all different disciplines 	<ul style="list-style-type: none"> • Re-assessing and careful designing of curriculum, well-structured specification • Making it a requirement by the relevant department • Careful planning to achieve all learning outcomes through non-modular assessments • Additional staff to enable adoption of the approach • Considering the needs of non-modular assessment when selecting and allocating modules among teaching staff • Develop specialised multi-disciplinary lecturers. 	<ul style="list-style-type: none"> • Better collaboration with the industry
<ul style="list-style-type: none"> • Obtain feedback from external and internal stakeholders involved 			

Analysis of potential benefits in section 6.2 demonstrated that many of the potential benefits will be for students and the industry. However, difficulties and suggestions to address those difficulties demonstrate that many of those are related to either academics or universities/programmes. Therefore, it can be seen that a lot of work needs to be undertaken

by the academics and the universities in implementing/introducing/expanding non-modular assessment practices; whilst these in the main will benefit students and the industry.

7. Conclusion and Recommendations

General acceptance was observed among academics involved that integrating non-modular assessment is applicable and will be beneficial in UG CM programmes (and other closely related built environment disciplines). Whilst a complete shift from modular assessment to non-modular assessment will require extensive re-designing of assessment practice, regulations etc, this does not seem as what is preferred by CM UG programmes under the current academic context. What is required by CM UG programmes is an approach where non-modular assessment complements that of modular-assessment in order to derive the benefits of both methods and deliver professionals with the problem-solving ability, applying what they have learned in individual modules coherently rather than in isolation. There was a strong justification and agreement to include and increase cross-disciplinary, cross-modular assessment due to the benefits such assessment will create. This is fundamentally due to CM being a profession that cut across many knowledge domains and disciplines, requiring CM graduates to possess a multi-disciplinary understanding on construction. Given that cross-modular assessment was considered as a form of non-modular assessment in this research, it was not attempted to differentiate between these concepts. However, if a strict differentiation is applied, there seem to be a stronger backing to enhance application of cross-disciplinary, cross-modular assessment rather than opting for a dominantly non-modular system, given the current programme structures.

The study identified that such practices can benefit students and the industry significantly. The main advantages identified in the study for students included the ability to obtain the understanding of the multi-disciplinary perspective, working collaboratively and reduced assessment load among others. It was identified that the industry would benefit by receiving graduates with an overall perspective, problem-solving, and team-working skills who will be able to quick adapt to working conditions. Whilst it was identified that there was potential to further apply non-modular assessment within CM UG programmes, it was noted that this has to be done with caution and proper planning. It was noted that technological innovations like BIM has enabled further application of non-modular assessment. Challenges that will need to be managed in doing so included student expectations and flexible study options, difficulties in marking and providing feedback, lack of industry experience among academics, difficulties in planning and scheduling assessments, and high resource requirements. Suggestions for improvements included improving practical knowledge of academics, cooperation among academics, and developing specialised multi-disciplinary lecturers.

Therefore, it can be recommended for higher education institutes to further expand their cross-disciplinary assessment practices within CM PG programmes. Means of doing so can include creating super modules to combine related modules, modules being assessed in combination with what was delivered in prerequisite modules, and having separate modules to bring different subject domains together; for e.g. integrated/multi-disciplinary project module. It is important that barriers that hinder application/further application are addressed appropriately. The need for the academia to work closely with the industry and vice versa was highlighted in order to reap the potential benefits of the approach. Given the government initiative to make applications of BIM widespread, the opportunities presented by the technology can be effectively utilised to expand application of non-modular assessment.

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This study was undertaken as an exploratory study and is the first step towards further research in this area. The study explored the perspective of the academics involved in designing and delivering CM UG programmes. A limitation of the study is that the findings reported are limited to the stakeholders involved; the academics. Whilst it can be argued that academics have been able to provide an account of all stakeholders involved due to their overall understanding of the CM UG education, a study involving all major stakeholders would be a suggestion for future research. A further descriptive study can be undertaken to investigate the perspective of the diverse stakeholders involved, such as the industry, professional institutes, university management, and students. Given that the construction industry that recruits CM graduates include a wide variety of firms representing contracting, consultancy, property development firms etc ranging from micro to large in size (with over 95% SME population), the views of all such industrial sectors will have to be represented in such a study. This will provide an overall perspective and whether the approach is favoured by all stakeholders involved. Further, the sample of academics involved in the study was small. A further suggestion would be to undertake a more expanded study to involve more academics using the deductive approach to test the initial observations made in the study. The findings reported thus needs to be interpreted considering these limitations of the study.

8. References

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