The 7i model: A common language for graduate attributes

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Note from the authors: This pre-print has been submitted for publication and is likely to undergo revision following peer-review. The pre-print repository will be updated with any changes and/or will link to the final accepted version.

Abstract

In recent decades, external pressures to align to the needs of industry and enhance graduates' employability have resulted in universities making efforts to define the qualities that distinguish their graduates. Many universities created lists of graduate attributes but there is little consistency in how these attributes are named and described from one university to another. This variation hinders communication and collaboration and makes it difficult to compare between universities and their different approaches. In this paper we sought to find patterns and similarities in the attributes adopted by universities in the UK to construct a universal and clear language of graduate attributes. In Study 1, we used qualitative content analysis to construct the 7i Model of Graduate Attributes, condensing lists of attributes from 27 UK universities into 43 attributes grouped into seven categories. In Study 2, we validated and refined the model using input from a variety of stakeholders. The 7i Model provides a clear and unified language for graduate attributes, enabling effective communication and collaboration in the area. The model has potential applications ranging from identifying suitable assessments for measuring students' graduate attribute development to curriculum development and quality assurance.

Keywords: graduate attributes, curriculum development, employability, skills, graduate attribute model

Introduction

Graduate attributes (GAs) are defined as the “qualities, skills and understandings a university community agrees its students should develop during their time with the institution” that “prepare graduates as agents for social good in an unknown future” (Bowden, Hart, King, Trigwell and Watts 2000). The term is mostly used in the context of undergraduate degree programmes, which is also the context surrounding this paper. While GAs have always been implicit in academia, there has been a worldwide effort to make them explicit (Page, Trudgett and Gawaian Bodkin-Andrews 2019). This change is linked to increasing pressures on universities to align their teaching to the needs of government and employers (Hill, Walkington and France 2016) and to enhance students’ employability through the development of personal attributes, core and transferable skills (Kalfa and Taksa 2013; Tran 2019). Despite this, reports from employer groups still indicate a gap between employer expectations and graduate skills, meaning not all graduates are considered ‘work-ready’ (Clarke 2018). The situation is made more complex by advances in technology and changes in society, meaning the work of equipping students with the GAs they need to succeed is more important than ever (Oliver and Jorre de St Jorre 2018).

In response universities internationally have adopted GAs (Hill et al. 2016), with many creating and publishing lists of attributes that define the qualities of their graduates. In the process of adopting GAs, and likely due to the competitive nature of higher education, many universities created their own discrete GA lists, designed to highlight the uniqueness of their graduates and the education experience (Clarke 2018). As a result, the attributes included can vary greatly from one university to another with little consistency when it comes to the attributes’ names or descriptions (Barrie 2006, Daniels and Brooker 2014; e.g. Problem solving is described as: *“To use a range of techniques and consider a number of options in a systematic manner, to find positive solutions to challenging problems posed”* [University of Bolton] or as *“The ability to identify and define problems and evaluate the merits of particular solutions”* [University of Leeds]). Furthermore, the process behind the development of these lists, and the selection of certain attributes, is not always clear (Aitken, Jones, Fawns, Sutherland and Henderson 2019). Institution-specific GAs also create confusion on the part of employers and students, since their expectations of graduate skills and how they are described vary across institutions. Consequently, there is a need to identify the core GAs higher education should develop and enhance student, academic and employer understanding of GAs through the development of a universal model.

Factors influencing attribute implementation

Stakeholder involvement (i.e. academics, students, and employers) is essential in the process of creating GAs (Spronken-Smith et al. 2016) but can be problematic when different groups have different perceptions about the relevance and importance of attributes (Barrie, Hughes and Smith 2009). Furthermore, stakeholders can interpret the same attribute in different ways (e.g. ‘problem solving’ can be taken literally by some groups, whereas others will interpret it as just gaining a deeper understanding of a problem; Green, Hammer and Star 2009), causing issues with communication and collaboration. Barrie et al. (2009) identified 8 factors that can influence the implementation and successful achievement of GAs including: conceptualisation – the different views that people have about what GAs are, student centredness – ensuring students actively engage and view GAs as worthwhile outcomes, and quality assurance – monitoring and assuring GAs development. In this paper, we argue that the core issue shared by these factors is a lack of clarity and consistency between and within stakeholders and can be addressed by a universal model of GAs.

For academics, whether they conceptualise GAs as basic ‘precursor’ skills (i.e. skills developed before coming to university, necessary but irrelevant to the discipline curriculum) or skills at the heart of tertiary-level learning outcomes can determine whether they ignore or actively participate in embedding, teaching and assessing GAs into the curriculum (Barrie 2006; Barrie et al. 2009). The ‘precursor’ view of GAs may stem from a lack of clarity surrounding the umbrella term ‘graduate attributes’, or by seeing GAs as too vague or generic to be relevant (Jones and Pate 2019).

For students, low engagement with GAs is also an issue (Barrie et al. 2009; Hughes & Barrie 2010). Similar to the views expressed by some academics, Jorre de St Jorre and Oliver (2018) found that students thought GAs were too generic to be meaningful and preferred to focus on what was relevant to their discipline and what was assessed. A focus on assessment and related criteria by students is well-known (Barrie, Hughes and Smith 2009; Gibbs 1999; Hughes and Barrie 2010) and engagement with GAs is made more difficult by the fact that they are typically difficult to assess (Barrie et al 2009; Oliver and Jorre de St Jorre 2018), in part because of the lack of agreement on attribute descriptions.

Finally, quality assurance plays an important role in improving institutional and academics’ engagement with GAs and driving progress in the area (Barrie et al. 2009). In the UK, the TEF (Teaching Excellence Framework) feature the development of “skills and attributes that are valued by employers and that enhance their personal and/or professional lives” as an assessment criterion (DfE 2017). However, there are concerns that

quality assurance is compromised by the lack of consistency between institutions (Daniels and Brooker 2014) which inhibits meaningful comparisons and evaluations.

A universal model of GAs with clear descriptions would demystify graduate attributes, helping to inform academics and students therefore supporting conceptualisations that enable successful implementation and engagement on both sides. Furthermore, implementing GAs in the curriculum is already resource-intensive (Cook 2018). It can become even more so if universities work in parallel rather than collaboratively to developing assessments tailored to their own attributes. A universal model could help focus limited resources on solutions that are more widely applicable and highlights the importance of a shared framework of skills, allowing for comparison between universities and supporting continued improvement and innovation in how GAs are implemented, taught and assessed.

Aims and objectives

Similarities and patterns in lists of GAs have been previously recognised in the literature, for example, Osmani et al. (2015) identified 53 recurring GAs whilst Bennett, Dunne and Carré (1999) proposed a model of GAs split into four categories. However, there has been no attempt to construct a model of GAs in which attributes are clearly described and categorised in a reliable and intuitive way. We propose that GA lists are sufficiently similar at their core to facilitate the creation of a universal model that can serve as a common language.

The aims of this research were therefore: (1) use content analysis to identify recurring attributes between UK universities and develop shared categories as the basis for a universal model of GAs, (2) derive clear names and detailed descriptions for the attributes and categories, (3) validate and refine the model using input from a wide range of stakeholders (i.e. students, academics, employers, educational developers etc.). In Study 1, we sought to answer the following research questions: *Are the graduate attributes at universities across the UK sufficiently similar in meaning to enable their reduction to a single model? If so, what are the common attributes and what do they mean?* In Study 2, the key research questions were: *Is the model clear and intuitive to different groups of stakeholders? If not, what changes need to be made to clarify or make the model more intuitive?*

Study 1: Constructing a universal model of graduate attributes

Method

Sample and data collection.

This study used secondary data in the form of publicly available lists of GAs collected from the websites of 27 universities across the UK. We started with an initial sample of all Scottish universities with publicly available GA lists (N=12). A matching sample of English universities (N=12) was then selected to compare the adopted attributes between the two countries. Sample matching was not possible for universities in Northern Ireland or Wales, as only one Northern-Irish and two Welsh institutions had published GA lists.

To match the Scottish and English samples, three factors were considered: the number of undergraduate students (as an indication of the institution's size), year of establishment (pre or post-'92 institutions), and types of degrees offered. Sampling was constrained to universities with publicly available GA lists, however, the closest possible match was sought in each case (see Table 1).

Content analysis.

Inductive qualitative content analysis (Cho and Lee 2014; Hsieh and Shannon 2005) was used to identify similarities and condense the 27 GA lists into a cohesive model of graduate attributes. The first stage of the analysis involved immersion in the data. After repeated readings, a preliminary list of primarily manifest codes (each representing a recurring graduate attribute) was developed. Each code was based on the descriptions provided via the university GA lists, with the aim of identifying similarities across the text (e.g. "An openness to, and an interest in, life-long learning through directed and self-directed study" and "Be equipped and motivated to continue learning and professional development throughout their careers" were similar in meaning and as such were both coded as 'Life-long learning'). There were varying levels of detail in the descriptions of each university's GAs (from a few words to a few sentences), therefore, although the codes were primarily manifest, some interpretation was required in a minority of cases to extract meaning from the data and appropriately code it.

Coding proceeded on an iterative basis, with new codes generated as the analysis progressed. After the semantic coding process was completed the codes were reviewed and refined, resulting in the merger of codes that were considered too narrow (e.g. 'investigating problems' & 'finding solutions' were merged to form 'problem solving') or further splitting of those deemed too broad (e.g. 'independence' started as one attribute but was split into four narrower ones which then formed a category). Once finalised, the codes were grouped into

categories (clusters of codes that shared common trends or themes). Finally, these categories were named and described using a data-driven approach. The coding process was repeated by a second rater to ensure reliability. The second rater coded 16 out of the 27 lists of attributes and the inter-rater reliability measurement was based on the codes, with the categorisation being fully agreed on by both raters.

Table 1

A list of all universities in our sample, showing the number of undergraduate students (provided by the UK Higher Education Statistics Agency for the 2016/2017 academic year) as well as the age category of each institution. The list of English universities matches the order of their Scottish counterparts.

UNIVERSITY	NUMBER OF STUDENTS	PRE/POST-'92
SCOTLAND		
University of Aberdeen	10,210	PRE-'92
Abertay University	3,460	POST-'92
University of Dundee	10,585	PRE-'92
Edinburgh Napier University	10,525	POST-'92
University of Edinburgh	21,640	PRE-'92
Glasgow Caledonian University	13,510	POST-'92
University of Glasgow	20,420	PRE-'92
Heriot-Watt University	7,415	PRE-'92
University of Highlands and Islands	8,055	POST-'92
Queen Margaret University	3,460	POST-'92
University of Stirling	8,585	PRE-'92
University of Strathclyde	15,590	PRE-'92
ENGLAND		
University of Reading	11,175	PRE-'92
Leeds Trinity University	2,855	POST-'92
University of Sussex	12,030	PRE-'92
University of Northampton	10,485	POST-'92
University of Leeds	24,345	PRE-'92
University of East Anglia	12,260	POST-'92
University of Sheffield	20,005	PRE-'92
University of Bradford	8,045	PRE-'92
University of Cumbria	6,890	POST-'92
University of Bolton	5,225	POST-'92
London Metropolitan University	9,400	PRE-'92
University of Essex	11,285	PRE-'92
WALES		
Cardiff Metropolitan University	8,790	POST-'92
University of South Wales	19,275	POST-'92
NORTHERN IRELAND		
Ulster University	19,160	PRE-'92

Results

Inter-rater reliability

Cohen's kappa (κ) was used to calculate inter-rater reliability as a measure of the agreement between the two raters. The kappa coefficient ($\kappa = .81$) indicated very good agreement.

Content analysis

Through content analysis we identified forty-three distinct and recurring GAs (codes) which were subsequently clustered into seven categories ('Implementation', 'Independence', 'Information', 'Ingenuity', 'Interaction', 'Introspection', 'Integrity'), and named the resulting model 'The 7i Model of Graduate Attributes' to reflect this categorisation. According to Cho and Lee (2014), in a typical qualitative content analysis, the final categories are mutually exclusive. Importantly, this is not the case in our analysis, as GAs are not discrete entities. There are numerous relationships and dependencies between GAs (e.g. teamwork involves communication) and as such, our categories are also inter-related but still meaningful and distinguishable from one-another. A brief overview of the data at the category level is presented below followed by tables detailing the attributes included in each category and their short descriptions.

Implementation.

This category encapsulated attributes that feature skills such as solving problems and putting plans and decisions into effect (Table 2). The ability to apply knowledge and skills in different contexts, and use this to solve problems was a common attribute: "*who can apply their knowledge competently in order to provide creative solutions to problems that arise in a variety of contexts*" [University of South Wales]; "*able to display (...) problem-solving skills and willing to engage with unfamiliar problems and articulate solutions*" [University of Sussex].

Universities also indicated their desire to foster the capacity to plan, organise and make important decisions in their graduates: "*Planning and Organising*" [University of South Wales]; "*Students are responsible and accountable decision makers*" [University of Northampton]. Finally, sustainability was mentioned both in relation to 'problem solving' and 'decision making': "*Developing solutions that are ethical, visionary, realistic and sustainable*" [Glasgow Caledonian University]; "*aware of the potential contribution of your work (...) and its impact on the environment*" [University of Cumbria].

Table 2

A list of all codes (GAs) and their short descriptions clustered in the Implementation category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Decision making	6	8	<i>Being able to weigh possibilities in order to make effective decisions.</i>
Enthusiasm	3	4	<i>Demonstrating passion and keenness when it comes to work or an academic subject.</i>
Knowledge and skills application	12	16	<i>Being able to contextually apply knowledge and skills.</i>
Planning and organising	3	3	<i>Being able to lay out plans and organise resources to carry out these plans effectively.</i>
Problem solving	21	48	<i>Being able to identify, define and solve complex problems in a variety of contexts.</i>
Sustainability	12	14	<i>Demonstrating commitment to sustainability, especially when solving problems and making decisions.</i> Updated definition after Study 2: <i>Demonstrating commitment to sustainability by making efforts to conserve an ecological balance and considering social and financial long-term viability when making decisions or implementing plans.</i>

Independence.

In this category, GAs concerning one's ability to perform, think, and act independently were clustered. Universities sought to develop graduates who are autonomous in their work and learning: *"The ability to work autonomously, take the initiative and to be self-directed in undertaking tasks"* [University of Leeds]; *"Are experienced in self-directed learning"* [University of Glasgow]. Some also wanted their students to graduate with the ability to think independently and develop their own ideas: *"Defend their ideas in dialogue with peers and challenge disciplinary assumptions"* [University of Glasgow].

Alongside being autonomous and self-directed in their work, the ability to take unprompted action, show initiative and be proactive rather than reactive was also valued: *"The ability to work autonomously, take the initiative and to be self-directed in undertaking tasks"* [University of Leeds].

Table 3

A list of all codes (GAs) and their short descriptions clustered in the Independence category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Independent work/learning	16	23	<i>Being able to self-direct and work or learn independently.</i>
Independent thinking	7	10	<i>Being able to think for oneself and question existing ideas, rather than just adopting others' thoughts or ideas.</i>
Self-management	12	23	<i>Being able to manage oneself, take care of own needs, and take responsibility for own actions and behaviour.</i>
Unprompted action	9	12	<i>Being able to take the initiative and being proactive rather than reactive.</i>

Information.

This category contained the greatest frequency of codes and encompassed all GAs concerning knowing, managing, and acquiring information. It is apparent from the GA lists in our dataset that universities did not just desire to develop specialists but wanted their graduates to maintain a life-long learning attitude and be able to evaluate information: “*Be equipped and motivated to continue learning and professional development throughout their careers*” [Abertay University]; “*Exercise critical judgement in evaluating sources of information and constructing meaning*” [University of Glasgow]. Some universities encouraged students to develop inter- and multidisciplinary understanding: “*understand the connections between different disciplines and be able to collaborate across disciplines*” [Leeds Trinity University].

Being digitally literate has also been included in this cluster, as universities often mentioned it in relation to finding and managing information: “*Confidently use a range of technologies for academic and professional purposes (...) Use appropriate technology to search for high quality information*” [University of East Anglia].

Table 4

A list of all codes (GAs) and their short descriptions clustered in the Information category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Commercial and professional understanding	10	14	<i>Having a real world understanding of how businesses and professionals work.</i>
Critical thinking	16	21	<i>Being able to critically analyse and evaluate information to reach an unbiased conclusion or make a decision.</i>
Digital literacy	9	11	<i>Being able to use digital platforms to find, manage, and share information, and to communicate.</i>
Information literacy	16	35	<i>Being able to recognize when information is needed, to find, analyse, and synthesize it. This includes traditional literacy as well as numeracy.</i>
Life-long learning	23	39	<i>Being intellectually curious and having the ability and desire to continue learning throughout life for personal or professional reasons.</i>
Multi-/Inter-disciplinary	8	11	<i>Having knowledge and understanding beyond their academic subject, and understanding the links between own and other subjects.</i>
Open-minded	7	9	<i>Being receptive to new ideas and change.</i>
Reasoning	6	6	<i>Being able to process information in a logical way.</i>
Research and enquiry	19	24	<i>Knowing how and being able to conduct research and enquiry.</i>
Specialist knowledge and skills	15	33	<i>Having skills and knowledge relevant to their academic subject.</i>

Ingenuity.

This category encompassed all GAs linked to being original, creating something new, or improving an existing idea, product or process in a new way. In addition to having the right information and being able to manage information and solve problems, graduates were expected to be creative and innovative in their approach. Universities were keen to promote the ability to creating new knowledge and ideas in their graduates: *“An ability to participate in the creation of new knowledge and understanding”* [East Anglia University] whilst graduates were also encouraged to show creativity, and the ability to make links between existing concepts and ideas, combining these in new, original ways was valued: *“Thinking creatively (...) and divergently, drawing on a range of ideas and unexpected connections”* [Glasgow Caledonian University]. Finally, universities wanted graduates to bring value to their organisations and focus this creative approach to drive innovation: *“entrepreneurs take on new ventures (...) spotting opportunities to make a difference”* [Edinburgh Napier University].

Table 5

A list of all codes (GAs) and their short descriptions clustered in the Ingenuity category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Creating knowledge	8	8	<i>Being able to develop new ideas and create new knowledge, using research and enquiry.</i>
Creativity	23	32	<i>Being able to use their imagination and original ideas to create something new or to combine existing concepts and ideas in a new way.</i>
Enterprising	11	13	<i>Showing initiative and resourcefulness.</i>
Innovation	12	18	<i>Being able to bring creative changes to already existing ideas, methods, products, or services. Similar to creativity but more focused on improving a certain product or idea.</i>

Interaction.

This category included all GAs linked to interacting and working with others. In their lists of GAs, most universities recognised the value of efficiently and effectively working with others and committed themselves to instilling these abilities in their students.

Communication was at the top of the list and was often linked to attributes both in this category and outside of it. Universities wanted their graduates to leave with the ability to communicate effectively through different means and, additionally, valued students' ability to adapt their communication style in different contexts: *“An ability to communicate effectively for different purposes, for different audiences and in different contexts”* [University of East Anglia].

Universities sought to help students graduate with the ability to establish networks and work with others both collaboratively and as part of a team: *“Students proactively connect with others, and exchange ideas to*

establish mutually beneficial working relationships” [University of Northampton]; *“Working collaboratively towards a common vision and common goal”* [Glasgow Caledonian University]. In addition to teamwork and collaboration, universities strived to help graduates be able to negotiate to reach consensus and show leadership abilities: *“demonstrating perseverance to reach consensus and obtain commitment to a shared vision”* [University of Northampton]; *“Inspiring and influencing the thinking, attitudes and behaviour of others”* [Glasgow Caledonian University]. Finally, some universities also committed to helping their students develop a professional conduct and a positive attitude towards feedback: *“Conduct themselves professionally”* [University of Glasgow]; *“Giving and receiving feedback”* [University of Highlands and Islands].

Table 6

A list of all codes (GAs) and their short descriptions clustered in the Interaction category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Collaboration	15	18	<i>Being able to work together with others to reach a common goal.</i>
Communication	22	57	<i>Being able to communicate with others in different contexts, for different purposes and audiences, and in various ways (e.g. oral, visual, written, listening, electronic)</i>
Giving and receiving feedback	5	6	<i>Being able to respond positively to feedback, as well as being able to offer feedback to others.</i>
Leadership	14	20	<i>Having the ability to lead others, directing, influencing them positively, and inspiring them.</i>
Negotiation	5	5	<i>Having the ability to negotiate with others to reach a consensus or shared vision.</i>
Networking	3	5	<i>Having the ability to establish and maintain professional connections with others.</i>
Professionalism	13	14	<i>Conducting oneself appropriately in different contexts.</i>
Teamwork	11	13	<i>Being able to work individually within a team, towards a common goal, understanding their role and the role of others in the team.</i>

Introspection.

In this category, we clustered all GAs linked to students’ capacity to know themselves, appreciate their own value, and to adapt and change. Universities expressed a desire to deliver graduates who are reflective and self-aware: *“To have a clear perception of your personality, strengths, weaknesses, thoughts, beliefs, motivations and emotions, and how these can affect your subsequent decisions and behaviours through self-reflection”* [University of Bolton]. Adaptability and Flexibility were often included in GA lists, and several universities brought up their desire to help graduates develop resilience: *“Respond flexibly and adapt their skills and knowledge to excel in unfamiliar situations”* [University of Glasgow]; *“To utilise effective coping strategies to withstand, learn from or recover quickly from difficult, stressful and challenging situations”* [University of Bolton]. Finally, universities sought to develop graduates who show confidence, self-esteem, and ambition: *“The*

Honours graduate can represent her/his own abilities with confidence and self-esteem” [London Metropolitan University].

Table 7

A list of all codes (GAs) and their short descriptions clustered in the Introspection category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Adaptability	19	28	<i>Being able to adjust to new environments and situations, as well as when seeking solutions to problems.</i>
Ambition	6	6	<i>Having a strong desire and determination to achieve success.</i>
Confidence	19	32	<i>Having faith in and relying on oneself and one's own skills, knowledge, and decisions.</i>
Reflection	19	24	<i>Being able to reflect on own work, progress, achievements, and self-identity.</i>
Resilience	7	7	<i>Being able to develop and use coping strategies to recover from difficult, stressful and challenging situations.</i>
Self-awareness	13	24	<i>Being conscious of own skills, knowledge, character and feelings, and how these can influence behaviour and decisions.</i>
Self-esteem	3	4	<i>Having an overall sense of self-worth or personal value and pride.</i>

Integrity.

This category was grouped all attributes linked with having a strong moral compass, an awareness and respect for diversity, and displaying a willingness to get involved for the good of the community at local, national and international levels. Universities described striving to deliver graduates that are active citizens: *“A global citizen, socially responsible and aware of the potential contribution of your work to the cultural and economic wellbeing of the community”* [University of Cumbria]; *“Exploring social problems and taking action to build a more just and sustainable society”* [Glasgow Caledonian University], whilst students were also encouraged to learn about diversity and respect the diversity of others: *“To understand, respect and embrace diversity, different cultures and different ways of working”* [University of Bolton]; *“Actively seeking a diversity of experiences and concepts from different cultural contexts”* [Glasgow Caledonian University]. Finally, universities aimed to help students develop and display moral and ethical behaviour in their personal and professional lives, as well as a good grasp of potential ethical issues in their fields: *“Understand and embody (...) honesty and integrity in their professional and personal lives”* [Abertay University].

Table 8

A list of all codes (GAs) and their short descriptions clustered in the Integrity category.

ATTRIBUTE/CODE	N (universities)	N (mentions)	DESCRIPTION
Awareness and appreciation of diversity	21	45	<i>Having an awareness and understanding of diversity in all its forms. Being inclusive, accepting and respecting diversity.</i>
Active citizenship	21	36	<i>Being aware and recognising one's own responsibility when it comes to social and civic issues.</i>
Ethical	21	33	<i>Having a strong moral compass and being aware of ethical issues in their field. Behaving ethically.</i>
Global citizenship	16	24	<i>Seeing themselves as primarily a citizen of the world and being engaged with and aware of international issues.</i>

The seven categories forming the 7i Model are summarised in Table 9 below. Together, they were meant to provide an easier way to conceptualise and navigate the high number of attributes that universities mentioned in their GA lists. Unsurprisingly perhaps, based solely on the number of mentions, universities seemed to focus disproportionately on communicating about GAs related to *Information* as opposed to attributes related to *Ingenuity*, for example. Importantly, there is no evidence that this disproportionate focus extends to the implementation of GAs in the curriculum and such an assertion cannot be made using any of the evidence in this paper.

Table 9

A list of all categories and their short descriptions, showing the number of universities mentioning each category as well as the overall number of mentions.

CATEGORY	N (universities)	N (mentions)	DESCRIPTION
Implementation	24	93	<i>Solving problems and putting plans and decisions into effect.</i>
Independence	24	68	<i>Performing, thinking, and acting independently.</i>
Information	27	203	<i>Knowing, managing, and acquiring information.</i>
Ingenuity	25	71	<i>Being original, creating something new, or improving an existing idea, product or process in a new way.</i>
Interaction	24	138	<i>Interacting and working with others.</i>
Introspection	24	125	<i>Knowing oneself, appreciating one's own value, and being able to adapt and change.</i>
Integrity	26	138	<i>Having a strong moral compass, an awareness and respect for diversity, and displaying a willingness to get involved for the good of the community at local, national and international levels.</i>

Study 2: Validating the 7i model of graduate attributes

After constructing the initial 7i model through content analysis, our second study aimed to validate and refine this model using input from a wide range of stakeholders. To do this, we sought to answer the following research questions: *Is the model clear and intuitive to different groups of stakeholders? If not, what changes need to be made to clarify or make the model more intuitive?*

Methods

Design and sample.

A mixed-methods custom-built online survey (programmed in HTML, CSS, JavaScript and PhP) was used to measure participants' agreement to our categorisation of GAs, their reasons for disagreement, as well as their opinion on the clarity of the attributes' names and descriptions. The survey was completed by 227 participants (see Table 10 for a breakdown of the sample) recruited via e-mail invitations and calls for participation on social media platforms. The six Non-UK participants were involved in GAs research and their responses were included due to their expertise. Participants' age was collected to test for potential differences in age, but the sample size did not allow for such tests.

Table 10
Showing the breakdown of our sample by occupation, age and location.

Occupation	N	Mean age	SD age	Location	N
Students	53	23.1	5.41	England	71
Graduates	13	30.3	8.12	Wales	5
Employers	14	46.3	12.42	Scotland	141
Academics	32	46.1	9.98	Northern Ireland	4
Careers & Employability Advisors	44	44.9	9.34	Non-UK	6
Policy-Makers	1	26.0	-		
Government	7	41.0	14.30		
University Management	18	44.7	8.30		
Educational Developers	30	48.2	12.69		
Other	15	39.7	12.25		

Materials and procedure.

To assess reliability and validity of the model, we programmed an interactive card sorting task (Figure 1). Participants were shown GA cards (one-at-a-time in random order) each containing the name and description of an attribute and asked to place it in one of eight boxes (one for each of the categories in our model and an ‘unsure’ box). All participants were instructed to choose the category they believed was the best fit for each attribute and they could reflect on their choice and re-categorise any attribute freely before reaching their final decision. If a decision could not be made about an attribute, participants were requested to place it in the ‘unsure’ box.

Figure 1. Screenshot of the card-sorting task interface.

Each participant’s categorisation of the attributes was used to prepare a set of follow-up questions tailored for each respondent. The aim of these questions was to expand on the rationale for their categorisation, where this differed from the 7i model, or discuss why a particular attribute could not be categorised. The survey was programmed to ask follow-up questions for a maximum of 12 attributes to keep completion time under 45 minutes. If the number of attributes that were categorised differently or placed in the ‘unsure’ box exceeded 12, the top 12 most difficult to categorise attributes were prioritised (the categorisation difficulty was assessed based on how many times participants moved an attribute between the boxes before making a final decision). Two questions were asked for the attributes left in the ‘unsure’ box: (1) ‘You placed this attribute in the UNSURE BOX. If this is because you couldn’t decide which category was best, please select all categories that apply’, and (2) ‘If there

is any other reason why you had problems categorising this attribute (such as an unclear name or description, or the attribute not fitting in any category), please give details below'. For attributes placed in a category other than in our original model we asked three questions: (1) 'Is there anything unclear about the name or description of this attribute? (If yes, please provide details)', (2) 'You placed this item in the <category name> category. Are there any other categories you think this attribute fits in? (If yes, please select all that apply)', and (3) 'Is there anything in particular that motivated you to categorise this attribute in <category name> rather than any other category? (If yes, please provide details)'. These questions were designed to gain insight into what motivated participants' decisions and whether they found the attributes' names and descriptions clear.

Data analysis.

Percent agreement was determined to be the most appropriate statistic to evaluate participants' agreement to our categorisation. The guidelines provided by Fleiss (1981) were used to interpret agreement as follows: <70% (poor), 70-79% (fair), 80-89% (good), 90-100% (excellent). The analysis had four possible outcomes: *confirm*, *move*, *split*, or *remove*. A decision was reached for each attribute using three factors:

- percent agreement for each category;
- alternative categories - this represents the percentage of participants who selected each category as an alternative choice when asked if an attribute fits in any other categories;
- the qualitative responses.

An attribute was *confirmed* or *moved* if percent agreement exceeded 70% (fair agreement) or if a combination of percent agreement, the alternative categories responses and qualitative data supported this decision. An attribute was *confirmed* if the majority category matched our original categorisation and *moved* if it differed.

An attribute was *split* if the qualitative evidence supported this outcome (i.e. if there were two different and equally supported interpretations of an attribute, then the attribute could be split into two separate attributes to reflect those interpretations). Finally, an attribute was *removed* no category was a clear fit and participants' qualitative responses indicated issues that would support this outcome.

Results

Confirmed attributes

Twenty-four attributes exceeded the 70% minimum agreement threshold for the original category (Figure 2). A further 10 attributes surpassed the 70% minimum agreement threshold for the original category when

taking into account participants' secondary choices (Figure 3). For these 10 attributes, the initial categorisation responses did not reach 70% agreement. However, a majority of participants chose the original category as their first choice and of those who did not, a majority agreed that the original category was also a good fit. Thus, the combined percentage of participants who chose the original category, either as a first or second choice was over 70%.

Figure 2. Bar chart showing participants' first choice in the categorisation task for the 24 attributes which exceeded 70% agreement. Line through 70% represents the minimum accepted agreement.

Figure 3. Stacked bar chart showing participants' first choice in the categorisation task and their alternative choices for the 10 attributes confirmed using alternative choices. Line through 70% represents the minimum

Three attributes did not surpass the 70% minimum agreement threshold, with or without considering the alternative categories data (Figure 4). The qualitative data was consulted to make a decision for each of these attributes.

Figure 4. Stacked bar chart showing participants' first choice in the categorisation task and their alternative choices for 'Adaptability', 'Ambition', and 'Reasoning'. Line through 70% represents the minimum accepted agreement.

Adaptability. *Introspection* was the most popular category for this attribute, chosen by 44% of participants as a first choice and a further 7% as a second choice. While this did not surpass the 70% minimum agreement cut-off, the proportion of participants who chose *Introspection* was higher than that of *Implementation*, *Independence*, or *Ingenuity* (16% each). Participants who didn't choose *Introspection* mostly cited dependency relationships between *Adaptability* and attributes in the other categories (e.g. "In order to adapt to situations, it's necessary to have autonomy. That's why I put it in INDEPENDENCE.", "each problem is unique and each solution is unique, thus when dealing with any problem you need to adapt"). Since the qualitative data showed no compelling reason to split or remove this attribute, *Introspection* remained the most appropriate category for *Adaptability*.

Ambition. Most participants chose *Introspection* as either their first (40%) or alternative (12%) choice, followed by *Independence* (28%). The qualitative answers to the reasoning question indicated that some participants found *Ambition* difficult to sort (e.g. "Wasn't really happy with putting it in independence but also couldn't see it fitting in anywhere else."). This was not due to an unclear description as most participants who answered found the description clear (150 asked, 30 answered, 27 clear, 3 non-answers). One participant indicated

that *Ambition* may not be a graduate attribute (“*Not unclear, but also not really something I think of as being a graduate attribute.*”), however, overall the qualitative data did not support removing *Ambition* from the model. Since a majority of responses supported our original categorisation (*Introspection*) the categorisation was confirmed.

Reasoning. Our original category, *Information*, was the most popular among participants (46%), followed by *Implementation* (28%). A further 20% of participants selected *Information* as an alternative choice. Qualitative responses to the reasoning question show that some of the participants who chose *Implementation*, did so only on the basis of a dependency (e.g. “*In order to solve problems and put plans into effect reasoning naturally is part of that process hence me choosing to include it primarily in the implementation category.*”, “*It is the process of using information in a logical way and in ways to make rational decisions. It could also equally fall under Information*”). This evidence supports our original categorisation, hence *Information* remains the most appropriate category for *Reasoning*.

Moved and removed attributes.

Enthusiasm. The quantitative responses for this GA were hard to interpret. Only 9% of our participants placed this attribute in the *Implementation* category, and the highest proportion of participants (28%) chose the *Introspection* category (Figure 5). Answers to the alternative categories question were also distributed between categories and did not prove helpful in identifying a single category of best fit. The qualitative data showed that participants found *Enthusiasm* difficult to categorise and saw it as a feeling, not an attribute (e.g. “*I think that enthusiasm is a matter of feeling and not a social, cognitive or moral attribute.*”, “*Nothing unclear about the description - unfortunately there's not a category for 'feelings'*”). Furthermore, participants indicated that it would be hard for some people to demonstrate this attribute and also hard to evaluate whether it is genuine or not (e.g. “*It feels very subjective and open to interpretation. How can I as an introvert demonstrate this?*”, “*Depends on why you would be demonstrating it - if it is only to look good to employer which this implies, then it is a weighted statement*”, “*This may be difficult to see in people so not sure how you would develop it.*”). Given these serious

issues, the apparent lack of consensus and difficulty to categorise this attribute, as well as the high (10%) proportion of people who placed it in the ‘Unsure’ box, we decided to remove *Enthusiasm* from our model.

Professionalism. *Integrity* was the most frequent category for *Professionalism* (47%), while the original category (*Interaction*) was only chosen by 26% of participants (Figure 5). The qualitative responses suggested that while our categorisation for *Professionalism* was focused on behaviour (i.e. ‘Conducting oneself

Figure 5. Stacked bar chart showing participants’ first choice in the categorisation task and their alternative choices for ‘Enthusiasm’, ‘Professionalism’, and ‘Sustainability’. Line through 70% represents the minimum accepted agreement.

appropriately in different contexts.’), our participants primarily associated this GA with moral, personal, and ethical values which made for a better fit in *Integrity* (e.g. “*Integrity included respect and understanding of situation around them which is a key part of professionalism. You can be professional without interacting with others.*”, “*I associate professionalism with integrity and ethical behaviour.*”). Given this evidence, *Professionalism* was moved to the *Integrity* category.

Sustainability. Most participants placed this attribute in the *Integrity* category (59%), while the original category (*Implementation*) was only chosen by 31% (Figure 5). These findings indicate that *Integrity* is a better fit for *Sustainability*. The qualitative responses showed that participants understood *Sustainability* differently than intended: instead of economic or business sustainability, participants thought of environmental sustainability. Nevertheless, participants mentioned that they consider both economic and environmental sustainability to be deeply connected to moral and personal values (e.g. “*If you mean sustainability in terms of the environmental impact, then integrity seems right. If you mean the solution/decision needs to have a lasting impact, then it still*

seems like integrity is the correct category.”, “*Sustainability is directly linked to CSR as well as environmental and moral values. Finding sustainable products and solutions to our business I would directly link with Integrity.*”). This evidence supported moving *Sustainability* to the better-fitting *Integrity* category and adjusting the definition to explicitly include the environmental sustainability angle participants mentioned (see Table 2).

Inconclusive results.

The results for three attributes (*Critical thinking*, *Life-long learning*, and *Open-minded*) were inconclusive. The percentage agreement did not surpass the 70% minimum accepted agreement for any of these attributes. The qualitative data cited dependencies to other attributes (e.g. “*I felt that critical thinking requires independent thought*”, “*Yes, because a commitment to lifelong learning requires reflecting on one's own skills and abilities, and recognising when changes need to be made.*”, “*Ingenuity requires being open minded and thinking outside of the box.*”) but did not support splitting any of these attributes. Unfortunately, there was insufficient evidence to make a decision regarding the most appropriate category for these attributes or to eliminate them from the model, as no major issues were mentioned consistently in the qualitative data. As such, we reached the decision of keeping these attributes’ original categorisation.

Figure 6. Stacked bar chart showing participants’ first choice in the categorisation task and their alternative choices for ‘Critical thinking’, ‘Life-long learning’, and ‘Open-minded’. Line through 70% represents the minimum accepted agreement.

General discussion

Study 1 focused on producing a unified model of graduate attributes from a sample of 27 UK universities using a qualitative content analysis. We found that, despite the variety of names and descriptions, the graduate attribute lists had clear similarities. The content analysis identified 43 common attributes, which were grouped into seven categories (*'Implementation'*, *'Independence'*, *'Information'*, *'Ingenuity'*, *'Interaction'*, *'Introspection'*, *'Integrity'*). To ensure the model covered a suitable breadth of attributes, each category was developed to include key related skills. For example, *Implementation* encapsulates cognitive skills such as problem solving and decision-making, skills which are often highlighted by employers as key selection criteria in the Industry 4.0 context (Kazancoglu and Ozkan-Ozen, 2018). In contrast, *Introspection* includes personal attributes such as ambition and confidence, aspects also highlighted within Clarke's (2018) model of graduate employability as important for career building and management.

Study 2 aimed to validate and refine the model with input from stakeholders. The results show that the categorisation constructed in the first study was robust with 34 out of 43 attributes retaining their original categorisation. One of the attributes, *Enthusiasm*, was removed from the model and another three attributes (*Critical thinking*, *Life-long learning*, and *Open Minded*) retained their original categorisation as there was insufficient evidence to either confirm, move, split or remove them. The analysis also suggests that the definitions were clear for all but one of the attributes for which sufficient data was obtained (i.e. *Sustainability*, for which the definition was adjusted).

This study represents the first attempt at creating a universal model of GAs with data-driven definitions. While other studies (Kember, Hong, Yau and Ho 2017; Osmani et al. 2015) have sought to identify recurring GAs, patterns, or to categorise GAs, the 7i model has several advantages. First, it was developed and validated with input from a wide variety of stakeholders, thus ensuring that different views of GAs and different agendas are represented. Second, the 7i model is more varied and inclusive in terms of the attributes it comprises. Third, our model provides clear data-driven names and descriptions for each attribute, disambiguating their meaning.

Our results highlight the range of attributes reported as important by universities and support the idea that an underlying common language for GAs exists. This universal model can be used as the basis for guidance on the emphasis of key GAs across UK institutions, reducing the current lack of clarity and understanding around GAs (Barrie, Hughes and Smith, 2009). Study 2, through inclusion of multiple stakeholders, also indicates the capacity of this model to bridge the gap in communication between academics and employers, which may help to manage employer expectations of graduates in the future. Certainly, a unified model of GAs should support students in focusing on, and articulating, the key skills for employers, something highlighted as vital in matching employer and graduate expectations (Succi and Canovi, 2019).

Limitations

The dataset used to construct the model in Study 1 only represented the perspective of the universities from which the GA lists originated. Furthermore, qualitative analysis is subjective by nature as the data is filtered through the researcher's lens. We sought to respond to both of these limitations in Study 2 by including the perspectives of various stakeholder groups to validate and refine the model. Nevertheless, the need to reduce completion time to under 45 minutes limited the amount of data we were able to collect. This meant that, in the case of some attributes, participants were not asked to indicate their alternative categorisation choices. Furthermore, there was insufficient data to determine whether all definitions were clear and understood by the survey respondents. Reviewing the definitions and ensuring their clarity should be the focus of a future study.

Implications for future research

For students and academics to take GAs seriously and engage with them, they must be clearly communicated, meaningful, relevant and taught as part of the formal curriculum (Jones and Pate 2019). Assessment and feedback are crucial in this process and there are several proposals for the assessment of GAs in the available literature (Aitken and Thompson 2018; Ipperciel and ElAtia 2014; Sampson, Moltchanova, Robertson, Bridgman, Suszko, and Russell 2018). However, none of them provide a reliable way of assessing the GAs which cannot be assessed using traditional assessment criteria but only through observing behaviour. e.g. Teamwork is generally not assessed; instead the product a team produces (a paper/presentation/portfolio) is evaluated. For these attributes, behavioural markers may be the best assessment method. Behavioural markers are examples of effective and ineffective behaviours that can support the evaluation of skills as well as giving learners feedback and direction for improvement (Flin et al. 2003) (e.g. Coordinating activities with team members would indicate good performance on teamwork, whereas failing to interact with team members would indicate bad performance). Behavioural markers have been used for decades in the assessment of non-technical skills as part of safety training in high-risk industries, such as aviation (Flin and Martin 2001), and they could be adapted for the assessment of GAs. The 7i model will next be used to develop a set of behavioural markers for the observable attributes in our model, alongside an assessment tool.

An accidental finding from Study 1 was that universities appeared to focus disproportionately on communicating about GAs in the *Information* category, both in terms of number of mentions (Table 9) and in terms of number of attributes. This was an interesting finding and future studies should investigate whether this focus extends to the implementation of graduate attributes in the curriculum.

Conclusion.

Graduate attribute lists from universities across the UK are much more similar than they might appear at first. In this paper we presented two studies which took advantage of these similarities to create a universal model of GAs. The 7i model is a robust framework constructed through extensive consultation with stakeholders. The model has widespread relevance for embedding GAs in the curriculum across the UK and beyond. It can be used to collaboratively develop new assessment methods; it provides a clear and simple language for GAs that can support communication and collaboration between stakeholders and can have implications for quality assurance by enabling comparisons between universities.

References

- Aitken, G., Jones, D., Fawns, T., Sutherland, D., & Henderson, S. (2019). Using Bourdieu to explore graduate attributes in two online Master's programmes. *Advances in Health Science Education*, 24, 559–576.
- Aitken, A., & Thompson, D. G. (2018). Using software to engage design students in academic writing. *International Journal of Technology and Design Education*, 28(3), 885-898.
- Barrie, S. C. (2006). Understanding what we mean by the generic attributes of graduates. *Higher Education*, 51, 215–241.
- Barrie, S., Hughes, C., & Smith, C. (2009). The national graduate attributes project: Integration and assessment of graduate attributes in curriculum. *Sydney: Australian Learning and Teaching Council*.
- Bennett, N., Dunne, E., & Carré, C. (1999). Patterns of core and generic skill provision in higher education. *Higher education*, 37(1), 71-93.
- Bowden, J., Hart, G., King, B., Trigwell, K., & Watts, O. (2000). *Generic capabilities of ATN university graduates*. University of Technology Sydney. <https://web.archive.org/web/20120628101655/http://www.clt.uts.edu.au/ATN.grad.cap.project.index.html>
- Clarke, M. (2018). Rethinking graduate employability: The role of capital, individual attributes and context. *Studies in higher education*, 43(11), 1923-1937.
- Cho, J. Y., & Lee, E. H. (2014). Reducing confusion about grounded theory and qualitative content analysis: Similarities and differences. *The qualitative report*, 19(32), 1-20.
- Cook, P. S. (2018). Examining the graduate attribute agenda in Australian universities: A review of (continuing) problems and pitfalls. *Learning and Teaching*, 11(3), 49-62.
- Daniels, J., & Brooker, J. (2014). Student identity development in higher education: Implications for graduate attributes and work-readiness. *Educational research*, 56(1), 65-76.
- DfE (2017). Teaching Excellence and Student Outcomes Framework Specification. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/658490/Teaching_Excellence_and_Student_Outcomes_Framework_Specification.pdf. Accessed 19 July 2020.
- Fleiss, J. S. (1981). *Statistical methods for rates and proportions*. New York, NY: Wiley.
- Flin, R., & Martin, L. (2001). Behavioral markers for crew resource management: A review of current practice. *The International Journal of Aviation Psychology*, 11(1), 95-118.

- Flin, R., Martin, L., Goeters, K. M., Hormann, H. J., Amalberti, R., Valot, C., & Nijhuis, H. (2003). Development of the NOTECHS (non-technical skills) system for assessing pilots' CRM skills. *Human factors and aerospace safety*, 3, 97-120.
- Gibbs, G. (1999). Using Assessment Strategically to Change the Way Students Learn. In S. Brown, & A Glasner (Eds.), *Assessment Matters in Higher Education* (pp. 41). The Society for Research into Higher Education & Open University Press.
- Green, W., Hammer, S., & Star, C. (2009). Facing up to the challenge: why is it so hard to develop graduate attributes?. *Higher Education Research & Development*, 28(1), 17-29.
- Hill, J., Walkington, H., & France, D. (2016). Graduate attributes: implications for higher education practice and policy, *Journal of Geography in Higher Education*, 40(2), 155-163.
- Hughes, C., & Barrie, S. (2010). Influences on the assessment of graduate attributes in higher education. *Assessment & Evaluation in Higher Education*, 35(3), 325-334.
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15(9), 1277-1288.
- Ipperciel, D., & ElAtia, S. (2014). Assessing Graduate Attributes: Building a Criteria-Based Competency Model. *International Journal of Higher Education*, 3(3), 27-38.
- Jones A., & Pate J. (2019). Students' Perceptions of Graduate Attributes: A Signalling Theory Analysis. In: Lygo-Baker S., Kinchin I., Winstone N. (Eds.) *Engaging Student Voices in Higher Education*. Palgrave Macmillan.
- Jorre de St Jorre, T., & Oliver, B. (2018). Want students to engage? Contextualise graduate learning outcomes and assess for employability. *Higher Education Research & Development*, 37(1), 44-57.
- Kalfa, S., & Taksa, L. (2013). Cultural capital in business higher education: reconsidering the graduate attributes movement and the focus on employability. *Studies in Higher Education*, 40(4), 580-595.
- Kazancoglu, Y., & Ozkan-Ozen, Y. D. (2018). Analyzing Workforce 4.0 in the Fourth Industrial Revolution and proposing a road map from operations management perspective with fuzzy DEMATEL. *Journal of Enterprise Information Management*.
- Kember, D., Hong, C., Yau, V. W., & Ho, S. A. (2017). Mechanisms for promoting the development of cognitive, social and affective graduate attributes. *Higher education*, 74(5), 799-814.
- Oliver, B., & Jorre de St Jorre, T. (2018). Graduate attributes for 2020 and beyond: Recommendations for Australian higher education providers. *Higher Education Research & Development*, 37(4), 821-836.

- Osmani, M., Weerakkody, V., Hindi, N. M., Al-Esmail, R., Eldabi, T., Kapoor, K., & Irani, Z. (2015). Identifying the trends and impact of graduate attributes on employability: a literature review. *Tertiary Education and Management*, 21(4), 367-379.
- Page, S., Trudgett, M., & Bodkin-Andrews, G. (2019). Creating a degree-focused pedagogical framework to guide Indigenous graduate attribute curriculum development. *Higher Education*, 78(1), 1-15.
- Sampson, K. A., Moltchanova, E., Robertson, I., Bridgman, C., Suszko, A., & Russell, D. (2018). A Roadmap for the Evaluation of Attributes in University Graduates. *New Zealand Journal of Educational Studies*, 53(1), 119-134.
- Spronken-Smith, R., McLean, A., Smith, N., Bond, C., Jenkins, M., Marshall, S., & Frielick, S. (2016). A toolkit to implement graduate attributes in geography curricula. *Journal of Geography in Higher Education*, 40(2), 254-266.
- Succi, C., & Canovi, M. (2019). Soft skills to enhance graduate employability: comparing students and employers' perceptions. *Studies in Higher Education*, 1-14.
- Tran, T. T. (2019). Graduate employability. In H. T. Bui, H. T. Nguyen, & D. Cole (Eds.), *Innovate higher education to enhance graduate employability: Rethinking the possibilities* (pp. 158-163). London: Routledge.