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INTERDISCIPLINARY COMMUNICATION SKILLS - FACILITATING STUDENTS FROM DIFFERENT DISCIPLINES TO LEARN WITH, FROM AND ABOUT EACH OTHER

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Abstract: Our group project involves exploring interdisciplinary communication skills and collaborative learning across STEM disciplines. In order to examine the topic we completed a literature review and surveyed staff about their views on interdisciplinary communication and collaborative learning at undergraduate level. We also held two focus group sessions on the topic with staff from three institutions.

Though one of our intended project outcomes was a design model for interdisciplinary approaches to communication skills, as a result of the literature review we have redefined our purposes and will instead, in the first instance, present guiding principles for the effective integration of interdisciplinary communication skills training into existing and future programmes. In this paper we outline the first draft of these principles which recognise interdisciplinary collaboration as a pedagogical 'trading zone' and see the development of communications between the disciplines as a necessary response to the realities of world complexity, the dissolving of boundaries between subjects, the need to combat excessive specialisation, the drive for rounded graduates who possess scientific literacy, critical and creative thinking, and expanded expertise, vocabulary and tool sets, in addition to the ability to communicate to wider audiences. In this context we report on how these principles have been impacted by the very recent moves to integrate arts-based subjects with STEM disciplines - moving from STEM to STEAM. We suggest that this is an important transition from which benefits for the student should arise.

Keywords; interdisciplinary communication skills, project-based learning, peer-learning, collaborative enquiry-based learning.

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1. Introduction

Despite the widespread recognition of the importance of communication skills development in higher education programmes, the effective integration of such training requires careful planning and coordination at the programme design and implementation levels. The authoritative US-based *Boyer Commission* (1998) is one of many which stresses the need for interdisciplinary communication skills intimately related to, and integrated with the subject matter, to enable undergraduates to pursue research projects. This Commission states that undergraduate research education in American universities must enable students to acquire strong written and oral communications, the skills of analysis, brevity and lucidity presented through inquiry-based learning forms (Boyer 1998:24). Ultimately undergraduates should be able to publish their research; a process facilitated in the US through the availability of undergraduate research journals, now also underway in England and Ireland (Walkington and Jenkins, 2008). Undergraduate research in the UK is the subject of a detailed report by the UK *Higher Education Authority* (Healey and Jenkins 2009) promoting interdisciplinarity in undergraduate curricula and citing multiple examples of same.

However, there may be some student resistance to these courses (Hannah 2004). Initial skepticism could be due to a lack of knowledge about the specific components of communication skills and the use of the term "communication skills," may suggest to students that they will be learning skills that they already possess. A related view is that skilled communication is common sense or acquired instinctively. Froelich and Bishop (1972) note that *'the ability to communicate skillfully and with purpose rarely occurs as a gift—it is learned'*. A large percentage of undergraduate students in New Zealand who had completed a communications course said they considered communication skills to be more important after having completed the course (Hannah 2004).

The value of STEM interdisciplinary study

Numerous benefits arise from an interdisciplinary approach to study:

1. It combats the harmful effects of excessive specialization (COFIRCOSCPP 2004).
2. It can address complex scientific and social problems, becoming an integral and durable component of research, higher education and public policy.
3. Where collaboration results in new solutions to problems, information may be fed back to the disciplines involved.
4. It supports changing career trajectories in line with the changing demands of the 21st century labour market.
5. Graduates are now required with strengths in critical and creative thinking, cultural and scientific literacy, and a commitment to team-working. Such skills require integrative strategies to enhance communication and collaboration.
6. It provides an expanded expertise, vocabulary and tool sets.
7. Students develop a widened sphere of professional reading and participation in new sub-fields and departments.
8. STEM graduates should possess the ability to disseminate scientific findings to a wider audience.

Barriers to STEM interdisciplinary study

1. Over-strong disciplinary allegiances at departmental and faculty levels (Boyer 1998).
2. An emphasis on 'signature-pedagogies' - discipline-specific pedagogical knowledge (Berthiaume 2008).
3. A reluctance of students to appreciate and engage with multiple different perspectives and methods.
4. Specialized methodologies and terminology may make interdisciplinary communication difficult.
5. Interdisciplinary modules and projects may be seen as soft or lacking in rigour.
6. Discipline-based staff may not be positive to a student-centred interdisciplinary pedagogy.
7. A lack of synthesis – students may be provided with multiple disciplinary perspectives but not given guidance in resolving conflicts to achieve a coherent view of the new subject.
8. Undergraduate students may lack intellectual maturity, making interdisciplinary projects unrealistic.
9. Interdisciplinary modules may lack autonomy or remain subservient to disciplinary demands (Burggren 2010: 130). They may be reliant on central funding which goes against the grain of the disciplinary department resourcing model.
10. The institutional reward structure may favour high-level faculty research over interdisciplinary work (Spronken-Smith 2009).

2. Existing and Emerging Approaches

A review of the literature relating to communication skills training in higher education reveals three general approaches, namely, stand-alone communication modules, embedded communications training and dedicated science communication courses:

a) Stand-alone Communication modules Traditionally and still commonly, communication skills are taught as generic stand-alone modules where topics such as academic literacy and personal development skills are taught in parallel with the core subject content of courses. An advantage of this method from a time-tabling perspective is that the module is relatively easy to 'bolt-on' to an existing programme without the need to modify that programme. However, a disadvantage is that these skills are divorced from core content, often taught by generalists with no guarantee that they could be applied in the disciplinary area. Moreover the status of such courses is often questionable with teachers of the disciplines and students themselves failing to recognize in advance their full value.

b) Embedded Communications Training A more modern approach involves embedding communication skills within the subject area (Amos and McGowan, 2012: 4). It has been argued that core content and communication skills development should be integrated within a disciplinary or interdisciplinary framework (Grant and Dickson 2006). However, such skills are not acquired by osmosis, and need to be explicitly recognised in the learning objectives and their assessment. The Aalborg model of Problem-Based

Learning is a good example of this approach. At Aalborg University project work accounts for 50% of the students' time and this percentage is also allocated to the project assessment (Moesby 2004). Studies show that this percentage is optimal in the sense of allowing students sufficient time to actively reflect on the application of the taught material in a real problem-solving scenario (Moesby 2002, Kjersdam 1994). DeGraff and Kolmos (2003) cite the absence of such alignment of time allocation and assessment methodology with target learning objectives as *'one of the classic mistakes made when changing to PBL'*.

c) Dedicated Science Communication Courses Indicative of the growing importance of science communication in general, this is a recent development in communication studies showing rapid growth. It integrates scientific understanding and the dissemination of such understanding to a wide variety of public and often non-technical audiences. Such courses often combine scientific literacy (often interdisciplinary) with techniques of oral, written, visual and online presentation skills. Theses courses may utilize workshop techniques and are often delivered by a combination of subject teachers and communication professionals.

3. Survey & Focus Group Feedback

We carried out a comprehensive survey of academic staff from across three universities, namely, the National University of Ireland, Maynooth, the Royal College of Surgeons in Ireland and Dublin City University. We received 75 responses from academics working in a broad range of STEM disciplines as well as business, education, careers and finance. The aim of the survey was to gather both quantitative and qualitative data relating to existing practices and attitudes on communication skills training at both undergraduate and postgraduate level across the three universities. Selected feedback is presented and discussed below.

Communication skills are an essential element of the Higher Education STEM/STEAM curriculum			
agree strongly:		78.7%	59
agree:		20.0%	15
disagree:		1.3%	1
disagree strongly:		0.0%	0

Table 1. Attitudes relating to importance of communication skills

As shown in Table 1, the vast majority of those who responded recognize the importance of communication skills development. There was also a strong consensus that the communication skills development should be integrated into the programme modules as opposed to through a 'bolt-on' module (Table 2). This raises the follow-on question as to whether these attitudes are reflected at the programme design and assessment levels. We explored this point further to find that just over half of the respondees had communication skills deliberately included in their discipline-specific taught modules (Table 3).

At undergraduate level, communication skills should be part of programme modules			
always:		57.3%	43
sometimes:		41.3%	31
rarely:		0.0%	0
never:		1.3%	1

Table 2. Integration of communication skills

The related qualitative feedback indicated that such training components typically took the form of written reports, assignments and oral/multi-media presentations. Such components were generally confined to within discipline-specific modules as opposed to spanning modules.

At present, are communications skills deliberately included in the discipline specific modules that you teach?			
Yes:		54%	41
No:		35%	26
Don't know:		11%	8

Table 3. Existing practice on communication skills

This was somewhat encouraging although it does raise the further question as to the extent to which communication skills were deliberately included in these modules. We explored this through a follow-on question, namely, *'if yes, where possible, please note the title of one module where this occurs and the percentage of time devoted to communication skills, as opposed to content delivery/negotiation, that occurs across the module'*.

The responses to this follow-on question indicate that the percentage of time devoted to communication skills was typically in the range 5% to 20%. This suggests that the widespread feeling of the importance of communication skills development is not generally reflected in the programme design and assessment. Also, the qualitative feedback from both the survey and the focus groups suggested that these communication skills activities where largely confined to specific modules with very little inter-module interaction even within a discipline-specific programme. The one exception to this was final year capstone project work which had the potential to draw on taught module content from across the programme and also allocated significant time and marks to communication tasks such as report writing, presentations, interviews etc.

At undergraduate level, communication skills should be discipline-specific			
always:		12.0%	9
sometimes:		69.3%	52
rarely:		14.7%	11
never:		4.0%	3

Table 4. Discipline-specific communication skills

We also explored attitudes relating to communication skills development within discipline-specific programmes/modules (Table 4). The responses shown in Table 4 show that more than two thirds feel that communication skills can be at least partly developed within a specific discipline.

In the literature there are several variations on the communication skills theme e.g. interdisciplinary, multi-disciplinary, trans-disciplinary communication. Such subtle variations can for some programmes safely be ignored at first-degree level where the emphasis is more on discipline-specific expertise and the effective and coherent integration of the fundamentals of good written, oral and multimedia presentation skills into these programmes. These latter goals should be a primary focus at undergraduate level even for programmes which are by their nature interdisciplinary e.g. biomedical engineering, manufacturing with business, and biotechnology production systems.

4. Guiding Principles

Based on the literature review and a preliminary analysis of the survey and focus group feedback we conclude that the systematic integration of communication skills training should be given strong consideration at all stages of higher education programme design, implementation, assessment and review. As a contribution to such considerations, we present the following set of draft guiding principles for the effective integration of fundamental communication skills training into existing and future programmes:

1. It would need to be seen as valuable. The perception would need to be shifted, so that rather than people just paying lip service, they would actually agree that it was valuable enough to include.
2. It needs to be adequately resourced.
3. It needs to be carefully designed, managed, aligned and sequenced, from programme design through to assessment.
4. The allocated programme time and assessment marks must reflect its importance as a learning outcome.
5. It must be integrated with the learning process. Learning happens in communication (writing, projects, peer learning, etc.) and learning is demonstrated through communication.
6. It must be integrated across the entire programme. A phased approach is suggested.
7. Staff need to have the necessary knowledge. For example, they need to be aware of existing matrices that might set out parameters for different phases in this approach.
8. Staff should be aware of what's going on in other modules, have a sense of what everybody is doing, be aware of the linkages and the 'big picture'.
9. Students too should be made aware of the 'big picture', of how the programme hangs together. They should be reminded of this from time to time.
10. Students need to be aware that this is a process. You become a more proficient communicator in your discipline over the course of your degree. (In the same way that you don't know your discipline after one year, or one module: this too is a process over the 3/4 years of your degree.)

11. Learning from the Aalborg model suggests that any type of collaborative project work needs to be tied in and linked with the semester's taught modules, in order to be successful.
12. For any collaborative group project work, staff need to have the necessary theory and know-how to implement successful and meaningful learning experiences.
13. Staff need clearer guidelines in relation to assessing individual contributions to collaborative work.
14. It may be considered possible to introduce shared interdisciplinary modules towards the end of a degree programme, depending on the programme.

5. Conclusions & Further Work

Divorcing 'communication skills' from learning (in 'bolt-on' modules) does not make sense when the demonstration of communication skills is also viewed as a demonstration of learning, succinctly described by a focus group participant as *'learning to communicate and communicating to learn'*. In other words, students' capacity to communicate (write, present, teach) reflects not only their communication skills but also their knowledge of their subject matter. There is widespread recognition among and beyond the higher education community of the importance of communication skills training in higher education programmes. However, this importance is not reflected in the design and implementation of many higher education programmes with 'bolt-on' communication skills modules and inadequate marks and time allocation being common place. Pressure to get through discipline-specific content-heavy curricula coupled with little incentive for academics to venture outside of their comfort zone are likely contributing factors to this mis-match. Some progress has nonetheless been made in systematically integrating process competency training such as communication skills, team-work skills, project management etc into higher education programmes without diluting the all-important discipline-specific learning objectives. Examples of institutions showing strong evidence of such progress are comparitively rare and generally result only from a coordinated effort by all stakeholders involved in the higher education programme in question. The educational model adopted in such institutions involves substantial group project work throughout entire programmes, for example, every semester is designed around a particular theme with approximately 50% of the time/marks allocated to a substantial group project associated with that theme and the other 50% allocated to taught modules also associated with the theme and having conventional exam-based assessment. We present the above set of draft guiding principles as work-in-progress points for consideration by anyone interested in systematically integrating communication skills training into their existing and/or future programmes. The next phase of our work is to apply these principles on a pilot basis within a number taught programmes across the three institutions and we invite the reader to join with us in this regard.

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