Addressing the needs of employers: writing development on undergraduate STEM programmes

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Aims

- to briefly review some features of STEM writing;
- to consider three models for academic writing development, and how they might apply in delegates' context;
- to reflect on four issues in mapping the curriculum to enhance writing development, to meet both academic and employability needs;
- to consider a range of examples of good practice

Models for maximising undergraduate writing development

Some features of STEM writing:

- **emphasis on positivistic and quantitative approaches**
- **in most cases drawing upon a scientific methodology (mathematics an exception?)**
- **strict conventions on reporting e.g. practical reports largely in impersonal and past tense using established structures**
- **close integration of text, tables and figures**
- **tendency towards use of passive construction**
- **tendency towards use of nominalisations**
- **often employ short, simple sentences and paragraphs (KISS principle)**
- **papers often written, working from data and their analysis outwards**
- **in essay writing, a thesis statement is usually avoided**

Models for academic writing development (1)

‘Writing across the curriculum’ (WAC)

- organisational model from the US in the 1970s
- ‘… the use of writing to engage students in the learning process’ (Ganobcsik-Williams, 2006, p. 50)
- ‘writing to learn’ is part and parcel of learning to write
- ‘writing to learn’ activities, embedded in disciplinary programmes, enable students to become comfortable with the language of their discipline
- students come to realise that there are different genres within the discipline, with different purposes, audiences and codes of practice
- writing development is strongly connected to disciplinary knowledge-making

Models for academic writing development (2)

‘Writing in the disciplines’ (WiD)

- a major pedagogical component within WAC (WAC Clearinghouse, 2011)
- or one or more curriculum initiatives with many similarities to WAC, but with a more bottom-up rather than a top-down organisational approach (Bean, 2001; Monroe, 2003)
- occasionally WAC and WiD are conflated for analytical review (Russell, 2001)
- see Deane and O’Neill (2011) for a recent review

Models for academic writing development (3)

‘Writing in the disciplines’ (WiD)

- **Monroe’s (2003) form of WiD. Writing specialists collaborate with disciplinary academics.**
- **‘Together, they examine aspects of the writing culture within a discipline and design ways of enhancing students’ opportunities to practice and acquire the range of capabilities they need to succeed at university and beyond’ (Samuels and Deane, 2008, p. 48).**
- **The influential *US News and World Report* listed WiD as one of eight academic programmes that prospective students and their parents should look for when choosing a US college. Among the 22 schools listed as having stellar WiD programmes are Harvard, Yale and Stanford.**

Models for academic writing development (4)

WiD in the UK:

- influential theoretical models that now inform WiD practice emerged during the 1990s as the HE sector expanded
- in meeting the needs of a larger and more eclectic intake, challenges arose, such as providing enhanced writing support for students from non-traditional backgrounds
- prompted new developments in academic writing research, such as writing practitioners working with mature students and addressing issues of power, authority, and identity as an author (Lea, 1994; Ivanic, 1995; Lillis, 1997, 2001)

Models for academic writing development (5)

WiD in the UK:

Table 1. Classification of students' meaning-making in HE based on Ivanic (1995) and Lillis (2001)	
Authority	Who do you want to be?
Authorial presence	How do you want to say it?
Authorship	What do you want to say?

Models for academic writing development (6)

- **student writing as a more contested form of discourse than traditionally advocated (Lea and Street, 1998)**
- **a framework for contextualising student's writing development**
- **classification that can be viewed as a hierarchy, with higher levels building on lower, and the potential for all three levels to apply in a given context:**

Models for academic writing development (7)

Table 2. Summary of Lea and Street's (1998) classification of models of students' writing development in HE	
Academic literacies	Writing as meaning-making and contested
Socialisation	Social encouragement into a culture, with writing as a more or less transparent medium of representation
Skills	Writing as a technical and instrumental skill

Models for academic writing development (8)

- more inclusive view – the academic literacies approach – in which issues of identity, meaning-making, and the contested nature of academic knowledge find prominence
- rather than developing writing ability being about ‘skills’ (a deficit model), it is widely acknowledged that it must be embedded within its social context (the upper two levels in Lea and Street’s classification)
- to what extent could, or does, the academic literacies approach take place in STEM programmes in your university’s context?

Models for academic writing development (9)

	Location(s)	Supporter(s)/Proponent(s)
Skills (deficit)		
Socialisation		
Academic literacies		

Mapping the curriculum (1)

At least four issues to consider in mapping the curriculum for a given programme in a particular subject:

1. **Identifying the particular qualities expected of writing in a given disciplinary tradition (community of practice) e.g. Pace and Middendorf, 2004**
2. **Considering the elements of writing, in a holistic manner (e.g. the IPACE model; Day et al, 2009; Day, 2011b)**
3. **Diagnosing the elements of writing, from large scale to small (e.g. Bonanno and Jones, 2007; Borg and Deane, 2011)**
4. **Scaffolding writing development across the years of an undergraduate programme, and in preparation for employment (Day et al, 2010; Day, 2011a, 2011b)**

Mapping the curriculum (2)

1. Identifying the particular qualities expected of writing in a given disciplinary tradition e.g. practical reports in first year Physics at UoB have particular conventions for:

a. report structure
   - Front matter: Title page and abstract
   - Body: Introduction, method, results, discussion, conclusion(s)
   - Back matter: Acknowledgements, References, Appendix

b. sections and subsections using digital notation
c. tenses
d. third person
e. critical reflection e.g. analysis of sources of error

and so on …

Mapping the curriculum (3)

2. **Considering the elements of writing, in a holistic manner (e.g. the IPACE model; Day et al, 2009; Day, 2011b). A student might consider:**

Identity Who am I as a writer within my discipline (community of practice)? How would I express that identity? What qualities should a person with that identity have?

Purpose(s) What is/are my purpose(s) in writing this assignment? What is/are the department's purpose(s) in setting this writing assignment?

Audience(s) Who is the primary audience for my work in this assignment? Is there a secondary audience? What assumptions can I make about their prior knowledge and understanding?

Code What format, structure, and writing style should I use for writing this assignment? What are the conventions?

Experience What am I bringing to the task in terms of the *content* of the assignment and the *process* of writing it? What knowledge, skills (abilities), values, attitudes and other qualities do I need to develop to help me?

Mapping the curriculum (4)

3. Diagnosing the elements of writing, from large scale to small

Bonanno and Jones, 2007 (MASUS model):

Use of source material e.g. relevance, correct interpretation, integration with text, free from plagiarism

Structure and development of answer e.g. genre appropriate, evidence of critical evaluation, development of argument through to conclusion

Academic writing style e.g. appropriate viewpoint, use of tenses, connectors, citing and referencing

Grammatical correctness e.g. subject/verb agreement, consistent use of tenses

Qualities of presentation e.g. use of sections and subsections, consistency of layout, spelling

Mapping the curriculum (5)

3. (continued)

Borg and Deane (2011):

Fulfilment of the assignment brief e.g. answering the question posed, responding appropriately to aims and objectives, using an appropriate organisation

Information structure e.g. logical flow of an argument within and between paragraphs

Sentence-level analysis e.g. variety, clarity and logical progression

Vocabulary analysis e.g. appropriate use of words within the disciplinary tradition

Proofreading errors e.g. grammar, punctuation, consistency, appropriate use of citations and references

Mapping the curriculum (6)

4. **Scaffolding writing development across the years of an undergraduate programme, and in preparation for employment (Day et al, 2010; Day, 2011a, 2011b)**

- The final year of an undergraduate curriculum can be highly focused on examination preparation and final project competition, with a strong academic emphasis
- This can run counter to employer's expectations (unless academic writing development has been well embedded in the student's experience so far)
- Our STEM project's research reveals that employers of new graduates in engineering expect graduate employees to engage in a wider range of writing (both audiences and purposes) than expected of them as undergraduate placement students
- Graduate employers and placement students both saw it as part of the university's role to prepare students for the writing students did on placements
- Employers also see preparing students for the writing they do in graduate employment as part of the role of the university

Pulling the pieces together

So, key issues arising from considering models of writing development and mapping the curriculum:

1. Moving beyond a skills (deficit) model of writing development
2. In terms of socialisation, seeking to make writing expectations explicit
3. Where possible, having subject specialists, careers advisors and learning/ writing developers working closely together using WiD approaches
4. Coordination between those offering the various kinds of writing support
5. Identifying the writing development needs for a specific discipline
6. Using a holistic model such as IPACE to consider the elements of writing
7. Diagnosing writing issues at different scales, from whole document to individuals words
8. Scaffolding writing development from first to final years of an undergraduate programme, through a range of communications and with employability in mind
9. By making the implicit explicit – and highlighting identity, purpose, audience, code and experience – students come to recognise the need to adapt for different kinds of communication, while developing the rigour of their writing overall

Examples of good practice

- subject specialists working with students
- writing specialists working with students
- subject specialists and writing/learning specialists collaborating to provide empowering learning experiences for students

  See also Kingston University's Skills Framework, KEYS/ Kingston Enhancing Your Academic and Employability Skills (www.kingston.ac.uk)

Disciplinary identity (1)

Lawrence Cleary at the University of Limerick – examining the texts of practical reports to reveal key conventions of the discipline

http://www2.ul.ie/web/WWW/Services/Centre_for_Teaching_%26_Learning/The_Writing_Centre/RESOURCES/%3E%3E_Student_Resources/Documents_from_Writing_Center_Presentations%2C_Seminars_and_Workshops

Disciplinary identity (2a)

Barrie Cooper at Exeter, working with first year mathematicians, 'What is a mathematician?':

- moving students from group work to expressing individually the qualities of a mathematician through writing for two very different audiences – prospective students and graduate employers
- encouraging students to reflect on their early learning experiences at university and their position in the mathematical community, and express these in writing
- at an early stage in a degree programme mathematicians are therefore encouraged to write for different purposes and audiences, and in very different styles, to nurture academic development while also enhancing future employability.

Disciplinary identity (2b)

Barrie Cooper at Exeter, working with first year mathematicians, reflective essay

Student empowerment (1)

Nicola King's work with bioscience students at Exeter:

- encouraging students to be researchers and 'change agents', identifying the needs and concerns of their student peers, and working with staff to mobilise effective responses
- creation of a biosciences writing handbook

http://www.bioscience.heacademy.ac.uk/ftp/resources/essayguide.pdf

Student empowerment (2)

Lawrence Cleary and Íde O'Sullivan's approach at the University of Limerick:

- developing student peer-tutors who work inductively and non-intrusively with students
- 'drawing out' rather than 'putting in'

http://www2.ul.ie/web/WWW/Services/Centre_for_Teaching_%26_Learning/The_Writing_Centre/WORKING_FOR_THE_CENTRE

A holistic approach

Trevor Day at the University of Bath:

- using the IPACE model as a planning tool
- feedback to students, from large scale to small scale

See ‘Developing Writing in STEM Disciplines’ Conference overview paper at:

http://go.bath.ac.uk/stemwriting

A lot from a little?

Allessandro Narduzzo at the University of Bath:

- a 200-250 word assignment for Physics students in the first semester
- effective communication to a target audience on a specific Physics topic
- integration of mathematical equation or symbolic expression with text
- use of a figure with text
- appropriate citing and referencing

- formative peer review
- simple and explicit mark scheme

Is the content clearly communicated?	**3**
Are title and overall presentation effective?	**2**
Word count	**1**
Equation(s)/Symbolic expression(s)	**1**
Figure(s)	**2**
References	**1**

Exemplars, with commentary

John Hilsdon at the University of Plymouth:

WrAssE - The Writing for Assignments E-library Project

- **collection of students' written assignments**
- **assessor's feedback given through the lens of a critical thinking framework**
- **reveals elements of writing such as viewpoint/authority, structure, voice and style**
- **highlights both good practice and areas for improvement**

www.learningdevelopment.plymouth.ac.uk/wrasse/

Take home messages

Use a writing development model (e.g. IPACE) to make more explicit the requirements for a given assignment or module

Scaffold development of identity and appropriate abilities, values and attitudes across the undergraduate programme, so that when students emerge as graduates, they are more confident, more well-rounded writers

Scaffold for employability as well as academic capabilities, using a range of assignments

And writing will have served as a powerful vehicle for helping students develop a deep understanding of, and an identity within, their discipline, as well as helping them prepare for employment

For further information

Visit http://go.bath.ac.uk/stemwriting

Also new HE STEM special interest group on 'Writing and Communicating in STEM Disciplines' is being set up:

- **internal event at UoB on 20 March 12.15–1.45 pm**
- **symposium at the Association of Learning Development in Higher Education Conference, University of Leeds, 2 April, 'Generic Graduate Attributes and Writing Development: How do they fit together?' (http://www.aldinhe.ac.uk/)**
- **special edition of the Journal of Learning Development in Higher Education, Autumn 2012, on the theme 'Developing Writing in STEM Disciplines'. Deadline for papers 30 April 2012. (http://www.aldinhe.ac.uk/journal.html)**