Case Studies of Research Based Curricula in College Based Higher Education (CBHE)

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The following summary case studies from the UK, Australia, Canada, Ireland, and United States were collected as part of an HE Academy funded project. They are categorised under the following groupings:

1. Arts, Design, Media and Humanities (5)
2. Business, Hospitality, Law, Sport and Tourism (7)
3. Education, Social, Environmental and Health Sciences (14)
4. Science, Technology, Engineering and Mathematics (13)
5. Interdisciplinary (3)
6. Institutional (8)
7. National (4)

Readers are invited to send us additional case studies of research-based curricula in CBHE using the same format as the ones which follow. In particular:

- Be brief (c250-350 words)
- Be specific as to what the student does
- Guide other staff/faculty how to shape their practice; so point to the key things they need to consider
- If available, provide details of relevant web sites and/or publications that provide further detail.

Please send your (draft) case studies to Alan Jenkins (alanjenkins@brookes.ac.uk).

1. Arts, Design, Media and Humanities

1.1 Shaping dissertation research in dance and music theatre: critical approaches and shifting methodologies at London Studio Centre, UK

London Studio Centre's BA (Hons) Theatre Dance programme, validated by Middlesex University, prioritises technical excellence in dance/music theatre performance and creative practice, based on a clear grasp of dance history and culture. The dissertation forms a key part of the Level 6 module M301 – Research: Putting Theory into Practice (40 credits). Modules at Levels 4 and 5 prepare the students for this task, establishing study skills and research methods appropriate for HE and developing critical and analytical tools to locate different dance practices, including the students' own creative practice, in a wider cultural context. The integration of theory and practice through dissertation research encourages students to develop the transferable graduate skills needed when

they enter the professional field, and indeed when they exit it, considering professional dance may be a relatively short-lived career. Furthermore, recent methodological shifts in the wider field of dance studies have led students, in conjunction with tutors, to develop tailor-made research methodologies. There is a breadth of interdisciplinary theoretical frameworks, combining insights from dance studies as a discipline with theatre studies, cultural studies, psychology, anatomy/ physiology or sociology. Many students choose to study topics in the field of popular culture, in line with the recognition of popular dance and music theatre as meriting academic enquiry; however, this is not without its challenges due to the apparent lack of substantial bodies of literature in these areas. Also, practice-based research in choreography and dance on screen is becoming increasingly significant.

Sources: http://elearn.mdx.ac.uk/criticalenquiry/abstractUytterhoeven.htm; http://www.london-studio-centre.co.uk/courses/ba-hons-theatre-dance

1.2 Engaging students with the latest research and publications in architectural design at Adam Smith College, Dundee College and Abertay University, UK

This case study relates to a collaborative programme delivered across two colleges and a university. The BSc (Hons) Sustainable Architectural Design is an award made by the University of Abertay Dundee and delivered at third and fourth year (levels 9 and 10 of SCQF) jointly by Adam Smith College, Dundee College and Abertay across each of the campus locations. The programme only draws applicants from colleges with existing HND awards therefore all of the students have come through the FE experience.

In the module, Construction Contracts and Environmental Law, the students are set specific weekly preparation tasks; motivating and obtaining deep learning and ensuring enquiry into latest research and publications is expected and tested across the class. The students are given prior notice of materials they can bring to class – but in the event that some students will not, for whatever reason, undertake preparation to further their knowledge for dealing with the class-based problems and issues, they are allowed to use their laptops, iPads, iPhones or other technology to access whatever information they might need to deal with the class-based problems, issues and tasks in addition to the questions at the commencement of a session. They are provided with either a detailed problem prior to class or a knowledge area to research and bring notes on which they are allowed to access during the tasks.

Students are questioned using a random system under which they all know they could be asked any question and there is some peer pressure for students to work together and prepare for the classes. The more answers correct the less time spent 'teaching' and more time discussing and engaging with the issues and problems, with the tutor's role to clarify misunderstanding and fill gaps in knowledge.

Source: Correspondence with Eddie Simpson (e.simpson@abertay.ac.uk)

1.3 Developing a research orientation in undergraduate creative arts in the Bachelor of Illustration at Northern Melbourne Institute of TAFE, Australia

The Bachelor of Illustration is a three-year undergraduate degree in the creative arts. Research is an essential component of the Bachelor of Illustration. Students investigate a wide range of visual art practices and draw on history, technology, commerce, media and cultural studies as they progress to analyse and critique the development of illustration and visual language. In the recent past two large mural projects were introduced in the first year of the program to establish a 'research sensibility' early in the program. These projects provide excellent industry-based opportunities for first year students to research and engage in an enterprise that has a clearly defined product at completion. The initial investigative research aims to encourage exploration and broad enquiry, through the use

of the library to develop information and academic literacies through the creation of relevant reference lists, bibliographies as well as accessing and compiling community resources relevant to the particular project. In addition, these activities build the skills and techniques, that create a shared peer supported environment of enquiry and dialogue to reach identified outcomes. The projects also provide scope for initial independent research. During the early phase of the research there are factors for consideration that may involve the specific communities living within the intended locations of the artwork. In the Mural Projects example, the students' investigative research directed their attention for the need to become aware of sensitive cultural, political and religious requirements for appropriate imagery for public display within a diverse ethnic mix. For the Child Care Mural Projects after initial research including parameters and constraints such as background exploration of subject matter, safety and enhancement, visual reference points related to the client, appropriate style, colour, generic stylised images of children, scaled designs for proportion, all students in the group submitted a range of designs. Subsequently, peer critique and peer review through facilitated group discussion created either a consensus decision where either an amalgamation of the designs or the best design was selected to be developed.

Sources: Correspondence with Colleen Morris (colleenm-va@nmit.edu.au) and Christine Spratt (christinespratt@nmit.edu.au); http://www.nmit.edu.au/courses/bachelor_of_illustration

1.4 Developing of a creative research culture for 'Top-up' Fine Art students through providing a choice of dissertations at Somerset College of Art, Taunton, UK

To extend and deepen a research culture for students topping up to a BA Fine Art a departmental decision was taken to develop the research options available to students for their dissertation module. Students now have a choice of three forms:
   1. The traditional 5,000-8,000 word *Thesis* module.
   2. A 5,000-8,000 word *Critical Commentary*. This research form explores the students work and ideas about their own Fine Art practice.
   3. A *Special Project* that requires a 3,000-5,000 word research document and the production of three pieces of studio work.
All three options have consistently proved popular with Fine Art students.

The diversity of research options empowers and motivates students; emphasises active learning; facilitates learning through the production of artefacts; and encourages reflective practice and first person enquiry. A sense of discovery, exploration and provisionality are therefore integrated into the research culture. Students are better able to develop their own interests and to engage deeply with learning processes. Learning strengths and weaknesses are better identified by students. Staff are challenged to respond to outputs from a creative range of learning and project forms.

Both staff and students need to consider very carefully the three types of research form, and the different assessment criteria each requires. Varied forms of assessment enhance the student learning experience and their insights into the nature of research. The distinctiveness of each research form is also highlighted. Conversely assuring standards across different forms requires careful discussion of marking criteria by staff. Students are placed in peer learning groups to support one another and, early on, to help discuss the relative merits of each of the research forms. A bridging module is also in place towards the end of the 2nd year to help students get started on their 3rd year so that the summer vacation can be used for primary and secondary research.

Source: Correspondence with Peter Hawkins (HawkinsP@somerset.ac.uk)

1.5 Integration of research-based learning with professional practice in the Art and Design (Foundation) Diploma (FdA) at Kingston College, UK

A. Through industry links

A crucial aspect of the FdA one year Diploma in Art & Design is the necessary skill development to meet the demands of being a professional practitioner through live projects and industry experience. The interdisciplinary live project involves students conducting independent visual research into the commercial viability of their art & design practice, in order to produce a series of well-crafted products for a pop-up shop within the Bentalls Department Store in Kingston upon Thames. Research includes customer profiles, production lead-time, skills analysis and material costing, packaging and sale presentation. From inception, the project is externally focused, with client feedback from Bentalls on pricing, advertising strategies and point of sale organisation. Students need to synthesise and act on this information in order to produce a range of products that clearly demonstrate how visually orientated research meets the needs and demands of the client.

Hence students are provided with the opportunity for students to gain real world experience, and to explore ideas within a public realm. Moreover it helps the students prepare for year two, in which they are required to explore external links more independently.

B. Through community links

Research-orientated professional practice and skill development is also supported on the FdA Diploma in Art & Design through community links, including a collaborative project with Burlington Junior School in New Malden. This involves year one students gaining valuable teaching experience through running painting and drawing workshops alongside professional teachers. Research undertaken prior to delivery includes a skills analysis of the age group, national curriculum requirements (focussing on cognitive and creative development) and the implications of teaching a widely differentiated student group.

Sources: Correspondence with Rob Miller (rob.miller@kingston-college.ac.uk) and Deborah James (deborah.james@Kingston-College.ac.uk); http://www.kingston.ac.uk/undergraduate-course/art-design-foundation-diploma-2013/

2. Business, Hospitality, Law, Sport and Tourism

2.1 Linking first and second year assessment strategies through researching the need for a local sports development project in a work based learning module at West Herts College, UK

In the second semester of the first year (level 4) Foundation Degree in Sport Studies (FDSS) learners at West Herts College, an average of N=16 (2009-2013) students study a Sports Development module. One assessment method within this module involves researching the need for a local sports development project. Students complete a project proposal form which is then presented to a panel for assessment. This enables students to complete research based inquiry into the physical activity and coaching needs of the local community. In addition to meeting learning outcomes specific to Sports Development, cross module links with Sports Coaching and Study Skills modules are also embedded through the completion of this assessment activity.

In year 2 (level 5), students are encouraged to approach employers with their first year Sports Development project proposals, to fulfil the requirements of their double semester work based learning (WBL) module. On average seven out of ten students use this opportunity with others seeking projects linked with marketing and management. Within WBL, students are required to network with employers to find a niche in the employers' market. Students develop, implement,

analyse and reflect on their implemented project proposals and this forms the basis for a 5,000 word mini final project / dissertation. In addition students are also required to support each other in an online learning community through use of Blogs and Wiki's throughout their project delivery, enabling them to maintain contact with each other and with teaching staff.

The nature of the inquiry based project in the first year enables learners to thoroughly research and investigate their potential projects prior to implementation in the second year, clearly showing study progression and academic skill development. Examples include: a proposal to increase female sports participation which resulted in a cricket enrichment programme at a local secondary school for year 8 females pupils and an employment opportunity for the FDSS student; a proposal to increase Sikh community sports opportunities which resulted in a varied sports enrichment programme at a local primary school within a Sikh community and established school-club links within the local area. The FDSS student involved in this later project was offered employment at the primary school and at the leisure centre at which a number of the school-club links were cemented.

Source: Correspondence with Charlotte Gale (Charlotte.Gale@westherts.ac.uk)

2.2 Students on the Foundation Degree Business Management and Enterprise undertake a management consultancy project at Sheffield College, UK

The management consultancy project is designed for second year (level 5) students to pull together the skills and knowledge they have gained during their time at the College by investigating an area of their own business or one that they work for. The students are given the role of external consultants who can look at the business objectively, while still using their contextual understanding to suggest a complex action plan for improvements on a particular area of the business. This topic area is decided on through a negotiation with course staff and the student's manager/business need. The choice made depends on student and tutor expertise as well business objectives. Examples include: 'Investigating the ways for Strawberry Student Homes to attract more students and increase letting of accommodation'; and 'An investigation into possible investment options to expand current customer base at Clobber Print'.

The module is delivered predominantly online with regular opportunities for formal, individual, formative feedback planned into the sessions. Students are encouraged to be independent learners and to personalise their own learning. This means group sessions are not always useful as learners have different content/knowledge needs as well as different contexts in which they work. Students can choose the most appropriate method to share their findings. They are given the option of a YouTube video, a seminar, Q&A session or anything else they think is 'appropriate'. So far all have chosen 15-20 min PowerPoint presentations. It is not required that the students implement their findings but the impact of their application must be assessed. The unit is vocationally focused rather than academically driven, although there should be examples of academic good practise employed. This means that the expectations are that the findings should be useful and should have been clearly justified within the business context.

Source: Correspondence with Joan Rudder (Joan.Rudder@sheffcol.ac.uk) and Alice Bailey (Alice.Bailey@sheffcol.ac.uk)

2.3 Student-led research journal in business at Newcastle College, UK

An understanding of academic publication as an integral component of scholarship is embedded within the final year undergraduate and Masters courses (levels 6 and 7) in business. Curriculum design emphasises a cross-disciplinary approach to research. The benefits of publication are communicated to all HE business students in terms of employability skills and preparation for further study.

A student-led on-line research journal has been established to disseminate student scholarship, usually the findings of dissertation projects, to an external audience. Entitled *The Seven Bridges Management Journal* (a title proposed by students), it provides a range of opportunities for their students, not only as authors but also as Editors, peer reviewers and members of the Editorial Board. Collaboration between staff and students is central to the ethos of the journal. The Editorial Board is composed of both staff and students, with students in the majority. Each submission is peer reviewed by at least one student and one staff member. The editor is selected from the student body and allocated a number of staff advisors. Some of the papers have been written by collaborative partnerships of staff and students.

Course leaders have noted that involvement in the journal seems to provide students with greater confidence in the value of their own work. Establishing a new student-led academic journal inevitably requires a considerable time commitment from associated staff, particularly in terms of guiding students through the publication process as peer reviewers and members of the Editorial Board. In time, it is envisaged that experienced students will begin to mentor new participants.

Sources: Correspondence with Jonathan Eaton (Jonathan.Eaton@ncl-coll.ac.uk); sevenbridges.ncl-coll.ac.uk; http://www.ncl-coll.ac.uk/higher-education/research-and-scholarly-activity

2.4 Marketing final year research project at Letterkenny Institute of Technology, Ireland

All students taking the Bachelor of Business (Honours) Marketing complete a major marketing research project as a partial requirement for the fulfilment of their BBS Honours Marketing. The Marketing Research Project (5 credits) module is the capstone marketing research module. Prior to this, all students complete two modules (equating to 10 credits) specifically related to the field and practice of marketing research. These modules are called Marketing Research Methods and Applied Marketing Research.

In the research capstone module learners must work in groups and source a business that has a research problem or opportunity that they can address. For example one group of learners recently worked with an established hotel in the locality to investigate the consumer decision-making process for the selection of a wedding venue in Co. Donegal. The methodology for this project included a focus group with five couples who were married recently in Co. Donegal and a structured survey (N = 100).

Learners are required to apply the principles of best practice marketing research throughout their project. They are required to design and justify a sound methodology, and execute that methodology, incorporating innovative marketing research techniques throughout. Learners present a copy of their research projects to the business. Learners are also required to maintain a personal log, detailing their individual research reflections, throughout the module.

The Marketing Research Project module (semester 8) is linked to a preceding module, Applied Marketing Research (semester 7). In this module, the continuous assessment requires learners to source a business that has a research problem or opportunity and design a suitable marketing research proposal to address that research opportunity. In the semester 8 Marketing Research Project module, learners revise the proposal and execute the proposed research.

The Marketing Research Project module is assessed by 100% Continuous Assessment. 80% of the marks available are for group work and the remaining 20% is for an individual submission. Group work is assessed in four stages; stage 1 (20% of group work) represents the literature review, stage 2 (20% of group work) represents the methodology, and stage 3 (40% of group work) represents the findings and analysis section. Learners are provided with marks and feedback on their performance

at each of these three stages. Stage 4 (the final 20% of group work) is for the resubmission of the final document; the Marketing Research Report. This report is also presented to the business.

In the individual submission, worth 20% of the module, learners must detail their personal research reflections. This must include information on areas they had special responsibility for, reflection of the division of labour throughout the project, and reflection on the research limitations.

Sources: Correspondence with Vicky O'Rourke (vicky.orourke@lyit.ie); http://www.lyit.ie/courses/businessstudies/lybbussbmarketing/

2.5 Introduction to academic publications in first year sports studies courses at Newcastle College, UK

Newcastle College has developed an approach for inducting students in research skills at the beginning of their first year (level 4) in their FdSc Applied Health & Exercise Science, Applied Sports Coaching Science, FdA Applied Sports Management & Development and Certificate of HE in Football Coaching courses.

In the first week of their study, students receive an induction session on academic writing which includes Harvard referencing and an introduction to the SPORTDiscus bibliographic database. As their first assignment, students are asked to access a specific article from SPORTDiscus and write a short analytical report highlighting the strengths and weaknesses of the argument presented. They are also required to include references to two other journal articles within their report. Upon submission, these assignments form the basis for individual discussions with their personal professional development tutor.

This approach to academic induction assesses the abilities of students to access online journal articles, critically assess them and produce a report using Harvard referencing. This forms the basis for any future developmental support provided on an individual basis. The article on which the report is based has been specifically chosen to be accessible by level 4 students (it even references autobiographies by Stuart Pearce, Bobby Robson and Michael Owen), as well as relevant to the courses of study. This activity demystifies the research process and demonstrates the academic rigour demanded within higher education as part of the wider induction process.

Sources: Jonathan Eaton (jonathan.eaton@ncl-coll.ac.uk); http://www.ncl-coll.ac.uk/higher-education/research-and-scholarly-activity

2.6 Learning and Development Practice Exhibition for first year students at North Lindsey College, UK

North Lindsey College is an associate college of the University of Lincoln with a range of higher education courses. To support their entry into higher education students taking business and management foundation degrees (approximately 50 students) take a year-long introductory module that helps them analyse, develop and enhance their approach to learning through independent research, drawing on learning and workplaces resources. An introductory exercise using learning theory, such as Kolb's Learning Cycle, together with an audit and SWOT analysis helps students identify both their current skills and areas they needed to develop. Subsequently an interactive lecture programme based predominantly on the academic skills identified by individuals was devised by the module leader. Seminars focused on tasks that sought to encourage students to gather evidence of progression and explored how to exhibit this in an innovative and creative manner. The latter was reinforced by web 2.0 technologies such as online forums, multiple choices quizzes and e-journal articles on reflective practice.

At the culminating exhibition students showcase their specific skills development, in conjunction with learning theory; local employers, further education students and course applicants were invited to attend and view some of the demonstrations, whilst the module leader assessed each student via observation and question and answer. Examples included: a ballerina optical illusion on learning styles, a mock Bruno Mars 'Lazy Day' music video, and a 3D iceberg on critical thinking.

Source: Correspondence with Louisa Hill (louisa.hill@northlindsey.ac.uk)

2.7 Second year business students undertake a research based paper at Bay of Plenty Polytechnic, Tauranga, New Zealand

The Polytechnic has a partnership with the University of Waikato to deliver the first 2 years of their business degrees through the NZ Dip Bus programme in Tauranga; students can then complete the remaining 3rd and 4th year (depending on which degree) in Tauranga or Hamilton.

Applied Management is a single semester research-based paper – generally undertaken in their second year - which requires student research teams to identify a management issue in an organisation, conduct research to identify problems and/or establish causes and recommend possible solutions. The paper necessitates collaboration between students and local organisations, and may involve solving problems identified by the organisation, or alternatively a deductive approach, exploring the application of a management concept, such as motivation, engagement or structure, using the organisation as a case study. Access to, and co-operation from the organisation is therefore a key component of successful project completion. Students work in teams to develop a research proposal outlining the background, rationale, research aims, methodology and an ethics statement. Research instruments are developed to gather primary data, a literature review scans relevant secondary data, and a research report and presentation outline the findings and recommendations. Finally students complete individual evaluations of the process.

For the majority of students, this is their first experience of research based study which necessitates the teaching of research methods, research ethics and writing a research proposal and report. Familiarisation with the 'language' of research is also needed. This material is covered in a series of seminars at the beginning of the semester, but once the proposal has been approved, research teams work independently under the supervision of the tutor, and tutors need to be aware of the varied level of support different groups and individuals may require in addition to academic guidance. Development of independent study skills is vital to student success. The research-based paper enables students to synthesise material studied in their other papers and provides students with the opportunity to investigate a management topic in depth. Results are excellent, in terms of student retention and success. Participants produce a tangible outcome which can be included in their graduate portfolio and the research and writing skills they learn prepare them for higher levels of study.

Source: Correspondence with Anne Bradley (Anne.Bradley@boppoly.ac.nz). Prescription:http://www.nzqa.govt.nz/assets/qualifications-and-standards/qualifications/NZ-Diploma-in-Business/Prescriptions/636-applied-management-V2.pdf

3.   Education, Social and Environmental Sciences

3.1 Engaging students with the research literature through discussion in Social Care at Shetland College, University of Highlands and Islands, UK

In the first year residential child care workers enrolled on the HNC Social Care programme at Shetland College, undertake the Protection of Individuals from Possible Harm and Abuse unit.

Assignment requirements include focus on evidencing knowledge and understanding of relevant reports, enquiries or research. This provides an opportunity for the learners to be exposed to the wealth of available resources. Three specific activities structure directed study in advance of a two-hour action learning set (ALS):

> **Activity 1:** read a research-based report and prepare a one-page summary identifying the purpose of the study, the sample, data gathering methods, ethical considerations and key findings (each student gets a different report);
> **Activity 2:** read a serious case review summary and prepare a one-page list of key points drawn from the recommendations (each student gets a different case);
> **Activity 3:** read a serious case review meta-analysis summary.

The ALS augments learning enabled via the directed study. Specifically each student presents their summary of the research-based report picking up each element of Activity 1, thus evidencing the early development of research-critique skills. The range of reports featured enables the breadth of potential sources of harm/abuse to be considered. Group discussion makes links back to the work setting, identifying implications for practice. Each member of the group then discusses what they learned from their allocated serious case review, making connections with the findings of the meta-analysis. The aim is to help the learners see that recommendations from single cases are part of a bigger picture which provides overall learning lessons.

In summary, the ALS evidences research-led practice - *learning about current research in the discipline* and research-tutored practice - *engaging in research discussions*. It introduces the learners to reports and research in a specific field, invites them develop critique skills and to connect research with practice. Analysis naturally occurs within the discussion, enhancing the learners' knowledge base whilst supporting their development as questioning practitioners.

Source: Correspondence with Fiona Smart (fiona.smart@shetland.gov.uk)

3.2 Giving Community College students in US their first experience of research in archaeology, USA

At Cuyahoga Community College, in Cleveland, Mark S. Lewine, a professor of anthropology, established a Center for Community Research. The center provided more than 2,000 students with their first experience with primary research in the field or laboratory. He encouraged graduate students and community college students to work together on archaeological digs. In 2006 he was awarded US Professor of the Year in the community-colleges category.

> "We're digging on abandoned church property, abandoned hospital property, doing land-use history of the inner city. The 'aha' response is immediate. They say, Oh my god, this land that we're living on actually has a rich history. They get very interested because it connects to them. They enjoy the subject while learning the process. Too many of our students, unfortunately, are working two or three jobs, have family responsibilities, and just don't have the time. Often the participation begins with an hour in the lab or on the site. Then they'll try to find time on a Saturday. What I tell my students is: If you like it, if you're learning with it, if you're reliable and consistent in your work, I will offer you internships. Plus I tell them: When you come from an urban high school that isn't giving you what your potential really needs, and a graduate school looks at your record and sees primary research, that makes your record stand out."

Sources: Bollag (2006);
http://www.usprofessorsoftheyear.org/Winners/Previous_Natl_Winners/Lewine_Acceptance_Speech.html

3.3 Students undertake a vocational research project in the Foundation Degree Public Services: Policing Studies at Sheffield College, UK

Students are required to complete a research module in year two (level 5). A blended teaching approach is adopted to provide support and opportunities to enable students to become autonomous learners. This is of particular importance to those wishing to progress to level 6 where they will be required to complete a dissertation. Having said that, most careers within the criminal justice system involve a degree of project management, research and report writing, so the module aims to provide key employability skills.

Given that the qualification is of a vocational nature, the topic or issue is ideally drawn from the student's work based learning placement and should be of specific interest to them. Examples from the current cohort are:

- A Special constable conducting research into the views of police colleagues towards the quality of personal protection equipment
- A Special constable conducting research into the attitudes of young people towards the police
- A student working with the government pilot criminal justice panels, conducting research into the public's general knowledge and attitudes towards restorative justice.
- A student working with youths on the edges of criminality conducting research into the attitudes of young people in relation to stop and search.

Learners are expected to formulate specific, measurable aims, carry out a literature review, examine and employ appropriate research methods and collect and analyse findings. Overall it is critical that consideration is given to research in methodological and "real world" crime contexts. Whilst the assessed piece consists of a 4,000 word report, students are encouraged to discuss their findings and recommendations with their WBL employer and future potential employers.

Source: Correspondence with Joan Rudder (Joan.Rudder@sheffcol.ac.uk)

3.4 Integration of years 1 and 2 (levels 4 and 5) undergraduate research experience in HND Applied Psychology at Truro-Penwith College, UK

The 2nd year Group Project module for psychology students has been designed to overlap with the first year course in two ways. Initially the 2nd years design their research in small groups of three to four students and in November they present to the first years their research question and their current design ideas. The 1st years are then encouraged to use what research methodology they have learnt to date to question the presenters, highlight strengths and possible weaknesses as well suggest alternative design ideas. The session is meant to be collaborative and positive and is facilitative by the tutors to ensure that this remains the case. The session is followed up by group tutorials in order to evaluate the contributions made in the presentation. At the end of the year the final projects are presented at a Student Conference where the 1st years see the culmination of the discussions and the final findings. The topics are chosen by the students after looking at British Psychological Society digest which is a collection of current psychological research reduced to an A4 page. These articles are used to generate ideas for workable projects. Although the research is conducted as a group each student may have their own slant on the research through individual research questions therefore each student is assessed on an individual dissertation report. They are also assessed on the Conference presentation as a group.

Sources: Correspondence with Cathy Schofield (cathys@Truro-Penwith.ac.uk); http://www.truro-penwith.ac.uk/ft/hnd-applied-psychology/

3.5 Sitting in the 'hot seat': Supporting students on foundation degrees to read critically at Sunderland, UK

This initiative began in years one and two (ie Levels 4 and 5) on two Foundation Degrees (Early Years and later Education and Care) at East Durham and Houghall College, a college franchise with the University of Sunderland. We found that students initially find reading for higher level study difficult. Stevenson and O'Keefe (2011) identified such students as 'searchers' rather than early 'researchers' and proposed the need to develop learner attributes of questioning and inquiry. To help the students make the transition to higher level reading we adapted the approach of Ginnis (2001) where the teacher sits in the 'Hot' seat of the classroom and students interrogate the teacher about their reading and understanding of an academic text.

We now model on a single occasion, the original strategy of Ginnis and in subsequent weeks we reverse the strategy by asking students to seek out, and locate literature of their choice, week by week reducing the level of guidance and enabling them to gain increasing independence, and autonomy in learning. When in class, they are asked to take a 2-5 minute slot, actively participating by being on the 'Hot' seat. When seated, they begin to share their critique of literature, they isolate key themes and dominant ideas, attempt to make sense of what is written and not written explicitly, this is shared in class with their peers and lecturer. This form of modelling critical thinking skills and practising the sharing of ideas with peers is important to broaden the lens of understanding, and provoke a sense of gaining new-knowledge.

The work of the 'hot seat' is on-going at both Sunderland and Northumbria University. In 2013-14 it will embrace wider academic staff and library facilities and will be evaluated at each year/level of study.

Sources: Correspondence with Jan Grinstead and Joan Goss (joan.goss@northumbria.ac.uk); Ginnis (2002); Goss and Grinstead (2013); Stevenson and O'Keefe (2011).

3.6 Building a research identity in the Bachelor of Education (Early Years) at Northern Melbourne Institute of TAFE, Australia

The Bachelor of Education (Early Years) is a four-year undergraduate degree that prepares pre-service early years and primary school teachers. The program attracts students from diverse backgrounds; many of whom are not well prepared for tertiary study. The program is committed to developing in students a 'research identity' from the outset as we believe that developing scholarship and a scholarly mind-set is crucial for professional teachers in practice. Students are introduced to research skills in Year 1. Subsequently, students are introduced to research-led and research-oriented teaching and learning. In this, students are required to participate in critical reading and discussion of research literature in order to understand research structures broadly and the impact of research on the field of education. Pedagogical approaches replicate the strategies that characterise research methods; students are engaged in learning activities that require them to undertake problem posing, that is, generating a research question, data collection techniques specifically those based on observation, and building their capacity to interpret data from a range of theoretical perspectives.

In the third year of the program, research-based activity is introduced to students as they develop and implement a self-reflective action-oriented research project based on their allocated teaching practice placements. This requires students to identify areas of their practice requiring improvement, to undertake a detailed focused literature review in order to understand the issue at a broader level, plan for observation and intervention in their identified area of practice and reflect on their progress across the project's lifespan. Students are required to formally present their projects to their peers and academic staff thereby demonstrating engagement in and exposure to peer

critique and peer review. Such an approach supports students' understanding of the research process at a personal level and also creates an understanding of the usefulness of the research process in professional learning and growth. In the fourth year of the program, students then plan and implement a research project in an educational setting. This activity occurs in a subject dedicated to the development of student's research proposals and related activity. Students are supervised to develop a research question in an area that interests them, they submit an ethics application and design their methodology accordingly. Students conduct this project in an educational setting and prepare a research report discussing the processes used and their findings.

Sources: Correspondence with Karina Davis (karinadavis@nmit.edu.au) and Christine Spratt (christinespratt@nmit.edu.au);
http://www.nmit.edu.au/courses/bachelor_of_education_(early_years)

3.7 Student research development on a foundation degree in Working with Children and Young People and BA (Hons) Childhood Studies at Stockport College, UK

Student research topics on the foundation degree centre on their practice within varied sectors, specifically Educational, Health and Social Care arenas. The teaching of research aims to acknowledge student practice and encourage them to keep abreast of current research techniques and recent developments within their diverse settings.

In the first year (level 4) research teaching commences by highlighting personal, academic and professional qualities and targets. Students delineate their professional, academic and personal strengths and targets - this is revealed following reflection. The emphasis on reflection is encouraged and assessed via the production of an autobiography (assessment 1) then subsequently by the composition of a personal development competence portfolio (assessment 2). In the next year (level 5), critical reflection is applied and assessed via the submission of a literature review on a chosen topic area. Additionally, students create a written research proposal where their student practice is embedded and connected with suitable research methods. The methodological teaching aims to enable informed research decision-making along with development towards the deeper processing skill of 'evaluating' research approaches.

The methodological approaches are outlined with reliability, validity and triangulation concepts being integrated into the proposal. 'Child Centred' approaches and student research values and beliefs are explored. The principles and values, methodologies and associated research areas may differ depending on the student subject specialism and sector. Students who go on to Honours (level 6) undertake their proposals.

Ethical issues are critical when researching children and young people. Power issues, data collection tools, child-centred principles and reflexivity arenas are incorporated into the delivery and discussions. The students submit their proposals to an ethics panel prior to conducting fieldwork in level 6. Students are encouraged to produce overviews of their research and these are visually displayed around the University Centre. Also, there is a conference titled 'Widening Horizons' and this celebrates student research.

Sources: Correspondence with Zoe Nangah (Zoe.Nangah@Stockport.ac.uk);
http://www.stockport.ac.uk/courseDetail?courseID=1982&courseTitle=Childcare%20:%20Foundation%20Degree%20in%20Working%20with%20Children%20and%20Young%20People;
http://www.stockport.ac.uk/content/widening-horizons-–-he-student-conference.

3.8 Developing contemporary curricula and experiencing practitioner-as-researcher through action research projects in Community Mental Health at Chisholm Institute, Australia

The first project aims to explore students' perceptions of a newly re-developed subject called Action Research Project A, which forms the final year first semester core module of the Bachelor of Community Mental Health, Alcohol and Other Drugs program. This program aims to cultivate the emotional resilience of students and teachers. The teacher, who is the principal researcher, identifies issues of professional practice suitable for action research and develops a research question which encapsulates the students' life-study experience and academic-based insights. The teacher discusses factors that initially prompt the question and how answering the question might improve curriculum and professional practice. The students also learn to question the role of the principal researcher and to analyse how such interaction influences the progress of their work. The students conduct a critical 1200 word literature review, which accounts for 20% of their final grade.

Students develop an action research proposal (2000 words, 30% of the final grades) and an ethics application that accounts for 20% of their final grades. This process is followed up by on-line reflective writing tasks, which include individual and group dialogue and inquiry, oriented around weekly readings and the online asignments (10% of the final grade). The teacher also develops a survey that covers: 1) Demographics; 2) Work, life, study balance; 3) Evaluation of teaching and learning questions; 4) Perceived satisfaction with the course and improvements made; and 5) Perceptions of how the course has contributed to student wellbeing.After receiving the Ethics Committee letter of approval students complete a survey, which contains a mix of open-ended and closed items. The teacher then enters and analyses the data and works with the class (20 students) to help them interpret the data and to plan the forthcoming publication. The teacher then divides the class into four groups of five students. Each group then has the opprtunity to present the findings and to provide their own solution or way forward at a reseach mini-conference. This task consists of a powerpoint presentation and highlights the solution for implemention of the findings in practice. Thus each group has their own interpretation of the data which accounts for 20% of the final grade. These participatory, collaborative presentations serve as a road map for the teacher who produces a draft publication at the end of the 12-week course, together with a group of students (6 volunteers) who are enthusiastic about the research and see themselves pursuing further studies defined by research. This process, with accepted changes to the curriculum, becomes an introduction for the second semster research subject.

The third-year second semster subject, Action Reasearch B, entails further implementation of the first semester Action Research Project A module for all students, within the Bachelor of Community Mental Health, Alcohol and Other Drugs program. The aims are to: a) reduce emotional experience destructive to the self and others; b) promote empathy and compassion towards intimates and others; and c) understand relationships between emotions and cognition, and promote psychological health. The graduate students from the Bachelor course participate, together with teachers, in a 42-hr training program (carried out in one-day sessions over six weeks), facilitated by a contemplative meditation expert/psychologist and a senior educator/research psychologist. The sessions include didactic presentations, practice related to meditation and emotional awareness and discussion of home practice. The overall assessment comprises self-reported measuments taken before training, immedietly after training, and six months later. The assessment is undertaken using: Five Factors Mindfulness Questionnaire; Positive and Negative Affect Schedule; and reflective journals, including an emotion and meditation diary. The findings of the qualitative and quanitative data are then dissmeninated in a number presentations and publications.

Sources: Correspondence with Anita Milicevic (Anita.Milicevic@chisholm.edu.au);
http://www.chisholm.edu.au/Courses/Bachelor_Degree/BachelorCommunity_Mental_Health_Alcohol_And_Other_Drugs

3.9 Year one students undertaking a Certificate of Higher Education explore the principles of community engagement through a group project at Gloucestershire University, UK

The *Certificate of Higher Education* (level 4) students on a *Community Engagement and Governance* course develop qualitative research skills through project work. They are part-time, mature, distance learners scattered across Wales and England. The following assignment task is designed to be completed both online and face to face at a residential school.

The module, *Achieving Sustainable Communities,* includes a group presentation (of 1,200 words, worth 20% of overall module marks). Students work in a multi-agency team of between 3-4 members to prepare a display demonstrating their understanding of three principles of community development (e.g. engagement, cohesion, ownership, capacity building, enterprise, and empowerment). Group members typically include a police officer, voluntary sector employee and a local authority councillor or staff member.

This display is assembled and marked over an intensive three hour period; with students given the 'brief' on the day itself. The assignment is designed to give them a realistic experience of joining a new community group. Members negotiate who will undertake what research tasks e.g. investigating and defining what a 'principle' is with reference to appropriate academic and/or practice literature; whilst another student pins down the meaning of community development. The group negotiates, explains and justifies why they selected their three key principles; setting down what each of these community development principles means, with a clear example of its use and value from life/team experience. Each member receives the same mark, unless the team suggests that someone should score higher/lower. The display should be a free-standing item, capable of conveying its message to the reader/viewer – unaided. This means that students do not present the display orally. Presentations range across paper-based posters through to PowerPoint's.

Within seven days each person writes a brief (200-300 word) individual reflection on how they feel the group developed during the activity, with reference to community development principles: were members *included/excluded*; did the display *integrate* all contributions? Did they gain a sense of *ownership* of the task? Dependent on the quality of reflection an individual student's overall score may increase by up to 5 marks.

Source: Correspondence with James Derounian (jderounian@glos.ac.uk); CEG102 Module descriptor available at: http://www2.glos.ac.uk/mda/2010-11/undergraduatefields/ceg/descriptors/ceg102.asp

3.10 Community projects for Foundation Degree in Community Engagement and Governance students at University of Gloucestershire, UK

This case study is research-oriented, based and tutored, enabling *Foundation Degree* FdA second year (level 5) students studying *Community Engagement and Governance* to develop their research skills. Students are part-time, mature, distance learners, mainly studying online (by Moodle/VLE) and scattered across Wales and England. Many of them are Parish Council clerks. The module *Community Projects* helps individuals to plan a project or solutions to community issues. It considers how needs, problems and opportunities in a community can be identified and examines resource planning as part of the project management process. There are linked assessments that encourage students to address a real life issue(s) or opportunity in a local community, whilst at the same time, gaining academic credit.

Assignment 1 is a 2,400 word report (worth 30% of overall module marks) in which they establish how, when and why a project came into being. And then show how the need for the initiative was, or could be, proven. In 2013 projects studied included a skate park; lunch club for frail elderly and an initiative to deal with anti-social behaviour. Most people then carried forward the same topic into

assignment 2 – a resource plan (3,200 words, worth 40%). This task requires analysis of existing and additional resources needed to achieve identified actions and objectives; determination of actual and potential providers of assets, and necessary additional resources. The student report presents options and recommendations in a form suitable for a project steering group.

The final, problem-solving assessment (30% of module marks; 2,400 words) is worked on in pairs. Each identifies a live 'wicked' problem within a/their local community, for the other to address. Rittel and Webber (1973) define wicked problems as having some or all of 10 characteristic e.g. there is "no definitive formulation of a wicked problem"; solutions to wicked problems "are not true-or-false, but good-or-bad" and that every wicked problem "is essentially unique". Individuals comment on their partner's recommendations for the problem they set; present a wicked problem they designed for their partner (and research and justify why they consider it 'wicked'), make recommendations related to their partner's issue, and reflect on the assignment and what they learned through the process.

Sources: Correspondence with James Derounian (jderounian@glos.ac.uk); CEG204 module descriptor available at: http://www2.glos.ac.uk/mda/2010-11/undergraduatefields/ceg/descriptors/ceg204.asp; Rittel and Webber (1973)

3.11 Students in the Bachelor of Nursing Degree undertake a research proposal during their second year at Holmesglen, Melbourne, Australia

The Nursing Degree prepares students for clinical practice as Registered Nurses. In the second year of the degree students undertake a subject focused on developing insight into the research process. The subject also fosters the development of group work skills through students working in small group of four students. Students are provided with a weekly series of lectures and tutorials to inform them of the key elements of the research process. During the weekly tutorials students are supported within their group and week by week, they develop a research proposal. This subject, concurrent to the research proposal development, also facilitates critiquing of nursing research articles. This further develops students' research skills and insight into the unique field of nursing re search.

In the first week's tutorial students discuss their understanding of the research process. In the second week they identify an area of interest for their research proposal. Then students weekly work through the elements of a research proposal including literature review, ethics and methodological issues. Although the students share content and develop elements of the proposal together, they are assessed individually as they provide an individual proposal for assessment. After the proposal has been developed, the groups then present their proposal to the rest of the tutorial group.

Source: Correspondence with Dr Peter McErlain (peter.mcerlain@holmesglen.edu.au); Malcolm Elliott (Malcolm.elliott@holmesglen.edu.au); and Bob Ribbons (bob.ribbons@holmeglen.edu.au)

3.12 Research in early years' education at Kingston College, UK

Kingston College offers three foundation degrees, all Early years based. As a part of a second year (level five) research project, students are supported in the preparation of a research proposal and in carrying out a rudimentary research project that aims to ameliorate the environment for children in their care. Each research project is underpinned by individual interests and the needs of their settings. Topics vary and can cover issues such as transition, visual timetables, dyslexia and sensory diet.

Each student is assigned a research supervisor. They are encouraged to investigate earlier research from theorists in the field. They contact those working at other universities who are currently researching or have produced research in the field. Cambridge University and Roehampton University have been instrumental in supporting requests from students who strive to understand the topic chosen for research. Research pods are developed for the exchange of ideas between those investigating similar areas; this facilitates the exchange of ideas and stimulates best practice that needs to be embedded in the industry. All methods of research are explored and students choose ways and means of gathering information including triangulation and the mosaic approach. Gantt charts are utilised in order to maintain the students' focus and if questionnaires chosen, Likert style questions may be utilised. Students are encouraged to use online systems and often employ Survey Monkey in order to obtain their data.

Sources: Correspondence with Jo Dallal (jo.dallal@kingston-college.ac.uk) and Deborah James (deborah.james@Kingston-College.ac.uk); http://www.kingston-college.ac.uk/course/833/foundation-degree-award-fda-in-early-years-management-and-leadership---sector-endorsed.html

3.13 Students studying Bachelor of Early Childhood Education and Care undertake an action research project at TAFE NSW, Australia

As a compulsory part of a Bachelor in Early Childhood Education and Care, students study research methodology in two twelve week semesters, as part of the second and fourth years of the degree. These research units consist of four hours of face-to-face learning each week to explore the different components of the action research model using inquiry-based learning. As part of learning about and implementing qualitative and quantitative research, students are required to conduct a research project based on an area of change they have identified in consultation with staff at an early childcare service. Working in pairs, students are required to complete a research proposal, implement their research in an authentic work-based context and write up their findings. The student pair up and then make recommendations based on the findings. Ideally these recommendations are taken up by the childcare centres in the future.

An example of research conducted compared two contrasting centre's school readiness programs which is defined as the transition preparing children for the move from centre based care or the home to school based settings. The student pair initially explored the relevant literature to clarify the best way to prepare children for school. Using qualitative research methods, the student pair conducted surveys of staff and parents asking about their beliefs regarding school readiness. The resulting data led to a finding that parents and staff had various and quite differing ideas on what constitutes a high quality school readiness program. The project recommended that more education for staff and parents about characteristics of school readiness programs which have proven to lead to positive outcomes would be beneficial to a program's success.

Source: Correspondence with Martin Brown (martin.r.brown@tafensw.edu.au); http://www.highered.tafensw.edu.au/courses/profiles/bachelor-of-early-childhood-education.html#.Ue5wEI21EgU; http://www.highered.tafensw.edu.au/documents/20510-course-profile.pdf

3.14 Engaging selected first year degree students in a collaborative research project on disability and rurality at Combined Universities Cornwall, Cornwall College, UK

Our research team included four first year students on the BA (Hons) Social Work degree who were integrating this research experience as part of their Community Development Project, four members of the Service User / Carer Panel and two academics. The aim was working as a team to interview local disabled people about their lived experiences. This 'emancipatory' or 'participatory' method incorporates student learning, service user perspectives and academic / theoretical underpinnings. It

also provides an opportunity for marginalised people i.e. the research participants, to tell their stories and have a voice.

The students were involved from the beginning. The first task was to rework and update the literature review (from a previous related study), redefine the research questions and identify potential research participants. While waiting for ethical clearance to be confirmed the students and service users attended training sessions on research methods, interviewing skills and later a data analysis workshop. In addition the students received academic input on social theory. Following this grounding students interviewed participants, either individually or in focus group situations; transcribed the data; and then proceeded with the next round of questions/themes (Grounded Theory). We then took a three week break which allowed time to 'immerse' ourselves in the data before conducting a two day final analysis excise which produced the key outcomes. The findings were then disseminated by the students to a range of audiences (e.g. local professionals, service users and academics as well as at university conferences in the UK).

Source: Correspondence with Dr Deborah Phillips (deborah.phillips@cornwall.ac.uk); http://www.cuc.ac.uk/

4. Science, Technology, Engineering and Mathematics

4.1 Biotechnology students work as part of a research team at Massachusetts Bay Community College, USA

Massachusetts Bay Community College (more commonly known as MassBay) is a two-year community college in Middlesex County Massachusetts. Their wide ranges of courses are particularly aimed at widening participation to first generation students. The Biotechnology programme is a very unusual, distinctive programme led by Dr Bruce Jackson. Students work with leading researchers on topics such as prostate and breast cancer, marine biotechnology and forensic DNA science. This research-based and peer mentoring-intensive program was designed specifically for non-traditional students and uses hands-on instruction and unique internship experiences. The pedagogy is that of a research team in a doctoral programme. After the two year programme students enter into internships and transfer to four year colleges. Approximately 50 per cent of Biotech students go on to pursue advanced science degrees through articulated partnerships and bridge programs with institutions worldwide. The programme has won many awards and received grants from the National Science Foundation and other major organisations.

Sources: http://www.massbay.edu/Who-We-Are/Mission-Statement.aspx; http://www.massbay.edu/Academics/Science,-Technology,-Mathematics-and-Engineering/Biotechnology-Program/Biotech-Programs.aspx

4.2 A collaborative research approach to the honours dissertation in computing and games design at South Essex College of Further and Higher Education, UK

The final year dissertation is a compulsory module (30 credits) on the BSc (Hons) Computing and Games Design. Learning takes place through a range of pedagogical methods according to individual and group's topic requirements. In each academic year there are on average 10-15 students. Students select research areas on the basis of the market requirements for the industry over the next five years (for example Semantic Web, Cloud Computing, Mobile Technologies, and so on). After initial investigations students select various directions within the main area which further develop their research questions within the main topic. The sub-topics are selected according to the student's technical development capabilities and research interest. For example, in a group of four students the topic can be further divided into four sub-topics. As the selected topic by each

individual is in same area of their fellows, it enhances their motivation and allows sharing of resources and peer discussion. The collaborative discussions help them to work on complex topics, while also giving them experience of working as team members. The project creates a professional working relationship where students help each other in a cooperative setting. This experience helps to enhance their employability. The module is assessed by evaluating the final presentation and a written report.

Sources: Correspondence with Faisal Mustafa; http://www.southessex.ac.uk/course/computer-games-design-bsc-hons

4.3 Research project and poster presentation in applied plant science and biotechnology at Myerscough College, UK

Undergraduate students experience research during the process of carrying out an experiment and producing a poster as an assignment for a third year (level 6) module. They are given the research background to the control of organogenesis (forming roots and shoots) in plant tissue culture and the accepted model of hormonal regulation. Students are then asked to devise an experiment to test this theory with a given type of plant culture, e.g. shoot tips. As a group, they decide what hypothesis is to be tested, the treatments to be applied to test their hypothesis, and the measurements that need to be taken. They then undertake the experiment, so in the process develop aseptic techniques, consideration of replication and experimental design. They then need to select appropriate statistical analysis and method of presenting the results. Students then report what they think are the major findings as a poster.

Students develop skills in discussing experiments and experimental design. It gives the students an opportunity to consider how the measurements to be taken can be standardised across the group. They need to think of using photographic and pictorial methods to present their findings. They gain skills in communication, particularly scientific communication and in the process of selecting and interpreting key information and presenting facts accurately and concisely. This exercise also provides opportunity to undertake data analysis and presentation, with staff guidance.

This research-oriented, research-based and research-tutored exercise compliments their dissertation modules. The dissertation is 40 credits in length and is compulsory for the honours degree. Although this exercise is delivered alongside the dissertation modules, the assignment is sufficiently early to enable them to apply the skills developed to their own dissertation in terms of establishing existing knowledge, developing hypotheses, designing the experiments, determining measurements, statistical analysis and the presentation and discussion of results. Even something as simple as developing an appropriate title, is discussed during the poster assignment.

Sources: Correspondence with Mick Cottam (mcottam@myerscough.ac.uk), David Elphinstone (delphinstone@myerscough.ac.uk) and Irene Weir (IWeir@myerscough.ac.uk); http://www.myerscough.ac.uk/downloads/pdfs/HE%20Module%20Catalogue/MR3203%20Applied%20Plant%20Science%20and%20Biotechnology.pdf

4.4 Course and program integration of early research experiences at Finger Lakes Community College, Canandaigua, NY, USA

In 2003, faculty at Finger Lakes Community College (FLCC) were invited to participate in a regional study on Eastern Red-tailed hawk populations. The study required both a field and laboratory component. FLCC was an appropriate partner due to its well-known Environmental and Biotechnology programs. Resources in the Environmental program were leveraged to help coordinate the field component while the Biotechnology program coordinated the laboratory portion. Anecdotal reports of positive gains in student learning outcomes led to an effort to increase

student exposure to the research experience. At the time, very few models existed with respect to integration of the research experience at a two-year institution. FLCC faculty conducted self-studies using Root Cause Analysis (RCA) tools to identify institution-specific barriers and then developed integrated solutions to those barriers.

In 2005, FLCC began testing a model that involved the development of classroom case studies that would be introduced into first-year introductory science courses. These case studies would be used to teach introductory course concepts within the context of an ongoing research project. The primary objectives were to demonstrate gains in introductory course student learning outcomes and increase the number of students enrolling in second year research-based courses. An evaluation of the pilot demonstrated gains in both outcomes. The results of the pilot were included in a proposal to the National Science Foundation (NSF) and eventually led to the establishment of the $3.35M Community College Undergraduate Research Initiative — a National project devoted to promoting the early research experience at community colleges (see Case study 7.1).

Source: http://www.ccuri.org/p8.php?pageID=345

4.5 Year 1 poster presentation conference in Engineering at Newcastle College, UK

In May 2013, the School of Engineering & Science organised a first year (Level 4) poster presentation conference, which provided an opportunity for students to disseminate the findings of their work-based learning (WBL) projects. WBL projects require level 4 students to identify and research an issue in the workplace relevant to their engineering discipline. Part of the assessment process includes a verbal presentation on their findings delivered to a general audience. Participating students came from a range of disciplines including electrical, mechanical, renewable and subsea engineering.

The event was hosted by students, with lecturers providing assistance and assessing their work. Posters were displayed on walls around the venue, with students presenting their aims, methodology and findings to visitors. Some of the students also displayed creative products developed in response to their findings. The conference was advertised widely across the institution. The event was aligned with the monthly information, advice and guidance event which attracts prospective FE and HE students, some attending with their parents. In this way, scholarly activity undertaken by students was disseminated to the general public as a positive feature of our HE provision. A local employer also participated in the conference.

Participation in the conference brought numerous benefits to students including developing presentation skills and gaining experience in presenting complex issues to a non-specialist audience. The event also contributed to the developing community of staff and student research within the School and it is hoped that the conference will become an annual feature in the academic calendar, and will be emulated in other areas of our HE provision.

Sources: Jonathan Eaton (jonathan.eaton@ncl-coll.ac.uk); http://www.ncl-coll.ac.uk/higher-education/research-and-scholarly-activity

4.6 Researching public perceptions of squirrels in FdSc Species and Ecosystems course at Otley College, UK

In 2004/5, there was a national call by The Department for Environment Food and Rural Affairs (DEFRA) for a cull on grey squirrels which were seen as impacting negatively on other wildlife. DEFRA were sensitive to public perceptions about this proposal and were waiting for a consultation to report back on this before enacting the proposal. Thus, this presented a perfect scenario for the students to do their own research and report in to public perceptions and how legislation could be

impacted by such considerations. The six to seven students had to research the DEFRA proposal, digest its content, and increase their knowledge of grey squirrel impacts from the literature before then designing their own public perception survey (thus engaging with social science research skills). They then went into a park where people came to feed the squirrels to engage the public and collect data (this, was done with staff in the background both for support and to assist students if questions got too difficult). They developed an information sheet to give to the public and, in pairs, collected data on public perceptions to the proposed cull. Having collected the data they shared the data between them and then analysed it in class (this introduced new data types and thus new analysis options) before then writing it up in two styles - a normal report and a summary in a newspaper style. This made a module that could have been dry and boring very much alive. It got them to engage directly with a national legislation making body and understand the decision making process, widen their research skills, understand the requirements needed to engage in public research (risk assessment, survey info sheet, name tags, knowledge on the subject to answer questions, etc). The best newspaper summary was submitted to the local paper and was published - which was celebrated by all the class.

Source: Correspondence with Angus Carpenter (carpenter.angus@gmail.com)

4.7 Engaging students in group projects lasting several years in Viticulture and Winemaking at Northern Melbourne Institute of TAFE, Australia

The Viticulture and Winemaking programs are strongly industry-based courses that attempt to empower students with the skills required to be competent, innovative practitioners in the wine industry. This industry has a long established spirit of workplace research, from both a food-chemistry and engineering perspective, therefore, it is been deemed imperative that students are exposed to applied research throughout their study. Rather than depend on stand-alone final year projects to fulfil this aim alone it was decided to instigate a traditional multi-faceted research project, spanning a number of years and requiring contributions from numerous student researchers working towards a common objective.

To integrate the project into the teaching programs staff teaching on the programme developed a roadmap to commercialisation outlining the key intellectual and technological milestones that needed to be overcome. The milestones were divided into three categories, (1) those that have a known solution and simply require time for analysis, and (2) those that didn't have a currently known solution but experimentation was out of the scope of student activities, and (3) those that didn't have a currently known solution but experimentation was within the scope of student activities. Milestones in categories 1 and 3 were then prioritised and given a rating of 1 to 3 depending on their perceived difficulty, aligning with the year-level that where students would have the knowledge/skills to undertake the task. Then each task was then allocated to a programme /course where it would be embedded into that year's practical activities. Students embraced both the challenge of this as well as the respect that it provided to them, and also gave them a legitimate feeling of contribution. All resulting publications are attributed to all staff and students involved in that particular component, providing an excellent 'CV boost' as new graduates.

Sources: Correspondence with Alastair Reed (alastairmreed@gmail.com) and Christine Spratt (christinespratt@nmit.edu.au); http://www.nmit.edu.au/studyareas/viticulture_and_winemaking; http://www.nmit.edu.au/courses/bachelor_of_viticulture_and_winemaking

4.8 Engaging students in applied research through industry sponsored collaborative capstone projects at Northern Alberta Institute of Technology (NAIT) Edmonton, Canada

NAIT's applied research program gives students the opportunity to put their learning to work in an applied, real-world project. They work with faculty, industry, and community partners to investigate

problems and opportunities proposed by our partners or sponsors. There follows two examples of capstone projects.

Students in the Bachelor of Technology in Technology Management (BTech) must demonstrate the integration of their learning through a Capstone applied research project before graduating. Partnerships are formed between BTech, industry sponsors, and student groups of three to four students, in order to pursue 'real world' applied research projects to solve industry problems. A faculty guidance team works closely with the student groups to generate research questions, develop research plans, gather and analyze data, and propose solutions. Projects in LEAN manufacturing, IT solutions, alternative energy, construction, and government policy are examples of applied research that has been undertaken in the capstone project. Students prepare a research report and present their findings publicly in a capstone symposium that is attended by industry representatives, faculty, and the general public. Curricular themes such as applied research methods, leadership, project management, ethics, and communication are emphasized throughout the capstone project as a way to transfer program knowledge to its many applications in society.

The Information Systems Development Major of the Bachelor of Applied Information Systems Technology (BAIST) degree program allows for students to interact and work with industry partners in the creation of a solution for a partner's needs. Students undertake two four month full time paid work experience. The work integrated learning internships make up the entire 4th year of the BAIST degree program. Students combine their technical and managerial skills to develop a scalable enterprise system for a real client. Some students have the option to engage in research work in integrating large system components into a complex organization. They are expected to contribute fully to solving the companies' problems using IT. We also require students to complete research paper(s) for grading. Along with demonstrations and presentations to stakeholders combined with what the student has learned over the program, this course prepares the students to easily blend into a corporation's context.

Sources: Correspondence with Michelle Ivanochko (MICHELLI@nait.ca); http://www.nait.ca/85862.htm; http://www.nait.ca/78678.htm; http://www.nait.ca/59951.htm; http://www.nait.ca/44779_91344.htm?utm_source=nait&utm_medium=feature&utm_campaign=homepage&utm_content=BTechstudentsdevelopuniqueprototypes; http://www.nait.ca/78568.htm; http://www.nait.ca/course_BAIS4991.htm?AsOfDate=2013-08-01

4.9 Inquiry-based learning in the Digital Media & IT (DMIT) program at Northern Alberta Institute of Technology (NAIT) Edmonton, Canada

Inquiry-based learning is an integral component of the Digital Media & IT gaming, programming and business analyst courses. In our advanced 4th semester gaming courses, students working in groups are using a brain computer interface device to explore concepts such as how will this tool change the world of gaming, how we can implement it in current games, what other fields could utilize the tool and building a game using the X-Box platform to show proof of concept. As a class, our business analyst students are working with a zoo to explore building apps for apes, more specifically what games would an ape play, why would they want to interact with the game and if successful could they suffer from gaming addiction as some human do. Working on this project, our students not only research primate cognition, but also how primates relate to humans in their interactions and decisions. In both cases the benefits of using inquiry-based learning was substantial. Other students in the program, as part of a partnership NAIT has with the Alberta Health Services' Glenrose Rehabilitation Hospital, have investigated how iPad technology can support disabled patient rehabilitation.

Sources: Correspondence with Michelle Ivanochko (MICHELLI@nait.ca); http://www.nait.ca/78131.htm; http://www.youtube.com/watch?v=ywv2sq7cM-E

4.10 An experiment with client defined applied research in a two-year engineering technology program at Northern Alberta Institute of Technology (NAIT) Edmonton, Canada

The two year Electronics Engineering Technology diploma program at the Northern Alberta Institute of Technology (NAIT) has traditionally included a fourth semester project course. Every student taking this course would identify a project that required them to design, build and demonstrate a microcontroller based product that incorporated several of the major themes taught in the two-year program. Our industry advisory board has been asking for greater development of real-world team work skills in our graduates so they can be effective at applying their technical abilities sooner. Rather than work in isolation on self-defined projects that may or may not have relevance to industry, we wanted to engage students in teams working on client-defined projects that were clearly relevant to industry.

An opportunity arose in 2012 to collaborate with University of Alberta researchers developing a cryogenic bio sample retrieval system. A mechanical gantry robot had been fabricated at the University. We were asked if our students could work on the control system for the robot. We offered the project to our fourth semester students. Volunteers were interviewed by the University researcher and by NAIT faculty. A team of four students was formed along with a NAIT supervisor and a University liaison. The team met with researchers at the University and a challenging but achievable scope of work was defined with deliverables at the end of the semester. The experience of working on a client-driven problem with all of the messy non-text book problems encountered in a real world setting provided excellent skill development for the team. Our student team delivered a solution within the scope of work and the client was very pleased. Based on the pedagogical success of this experiment, we are looking for more opportunities to have our students collaborate with industrial clients.

Sources: Correspondence with Michelle Ivanochko (MICHELLI@nait.ca);
http://www.nait.ca/76768.htm

4.11 Undergraduate research experiences for Chemical Technology students at Ivy Tech Community College, Indiana, USA

Ivy Tech Lafayette is a two year college enabling entry to one of Indiana's four year universities. Chemical Technology is a unique science program in that the Associate of Science is a terminal degree (ie there are no Bachelor, Masters programs in Chemical Technology). Most students prepare for direct entry into the workforce, with some choosing to transfer to four-year institutions. The Chemical Technology curriculum has been designed to maximize the practical experience of students by embedding a long term research project within several of its courses. The project commences in the spring of freshman year when students complete a data-mining assignment on the biosorption of heavy metals from waste water in CHMT 102 (Scientific Computing and Data Analysis). The following fall, those students will then take CHMT 210 (Quantitative Analysis) and CHMT 201 (Spectroscopic Methods) where they will perform one experiment in sample preparation, and one where samples are screened for biosorptive activity. In their last semester, the students enroll in CHMT 204 (Scientific Presenting) where they engage in guided inquiry-based experiments that follow-up the results of their preliminary screening studies from previous studies. In completing this course, students are required to give regular research updates, write progress reports, and create a research poster. All students are required to present their research at an Undergraduate Research Symposium on campus. Some students have elected to present this research at national and regional meeting of the American Chemical Society. As the project evolves, there are plans to incorporate it into other courses.

Sources: Correspondence with Douglas J. Schauer (dschauer1@ivytech.edu);
http://www.ivytech.edu/chemical-technology/; http://www.ivytech.edu/lafayette/

4.12 Students undertaking Diploma in Engineering analyse mechanical or electrical engineering design problems and identify possible solutions in final project at Bay of Plenty Polytechnic, New Zealand

Undergraduate students completing the second year of a polytechnic Diploma are required to undertake a semester-long research project as a culmination of their learning. Once the topic is agreed, students research existing solutions, create and trial variants or innovations, then record, assess and refine their processes. Bay of Plenty Polytechnic has strong connections with local industry and national bodies; wherever possible, the projects are guided by jointly developed proposals which address real-world workplace issues. Students are involved in every aspect of the project development and negotiate project parameters, scope, timeframe, resourcing and intended outcomes with both the industry sponsor, and the program teachers. They are required to follow good engineering practice and apply rigor to all phases of the research, according to both industry and academic standards. Reporting occurs at agreed intervals, and includes class presentations and a final, comprehensive written document with complete calculations, technical drawings, photographs, schematics, and graphed results – data included is dependent on the topic investigated. Assessment is again a collaboration between the sponsor organisation and teaching staff. Examples of projects are:

- An investigation into heat treatments of laser sintered titanium products to create a more elastic, impact resistant product
- Determining the viability of a wood stove flue heat-exchange system for domestic hot water and/or radiator hydronic systems

As well as research and practical skills, students learn about project management and liaison between stakeholders, and enhance their verbal and written communication skills. For some, the introduction to an industry organisation has led to employment and on-going opportunities.

Sources: Correspondence with Uli Fuerst (uli.fuerst@boppoly.ac.nz) and Mark Hendry (mark.hendry@boppoly.ac.nz); https://www.boppoly.ac.nz/go/programmes-and-courses/electrotechnology-electrical/new-zealand-diploma-in-engineering-electrical

4.13 Partnering with local small businesses gives students the opportunity to do laboratory research and work with entrepreneurs at Harold Washington College, Chicago, USA

Through a National Science Foundation grant, students from Harold Washington College, an urban community college in downtown Chicago, IL, are working with a local start-up company, Thermal Conservation Technologies, Inc., to develop and test new products for the vacuum insulation panel market. Currently, two students work full-time during the summer and part-time during the academic year in TCT's laboratories. The students are co-mentored by a community college science faculty member and the company president. Because the collaboration integrates both academic and commercial aspects, students learn to do fundamental research and transition it into applied engineering aimed at product development. They have also gained an understanding of how scientific research leads to new products and innovations, and how markets drive the need for new research and development from the scientific community. Students present their work in both academic and technical settings, which builds their communication skills. These presentations also showcase how supporting STEM education supports the development of new products for the marketplace and creation of new jobs in the community.

Sources: Correspondence with Thomas Higgins (tbhiggins@ccc.edu); http://www.nsf.gov/eng/iip/sbir/Supplement/; http://www.ccc.edu/colleges/washington/Pages/default.aspx.

5. Interdisciplinary

5.1 Enhancing employability via community challenge research at Blackburn College, UK

The project used the context of employability to introduce an enhanced form of independent learning. Small interdisciplinary teams of tutors and students worked collaboratively to produce work that could benefit their local community. The teaching positions of 'edupunk' and 'anarchogogy' were put forward to stimulate levels of creativity and innovation. To support these reflections the students were introduced to OERs (open educational resources) and OEP (open educational practices) through a blended learning programme of lectures and seminars.

Community Challenge was designed to give the students the chance to develop some of the more elusive employability attributes frequently mentioned by employers such as "ability to demonstrate an innovative approach, creativity, collaboration and risk taking" (Pegg *et al.*, 2012, 19). The teaching methods facilitated independence by placing the students at the centre of the project with responsibilities for directing the learning and establishing the areas of inquiry. The 'student as producer' approach focused the project on social issues and guided participants towards generative learning relationships with their communities.

The focus on employability created a professional learning environment that included two business 'away days' at a local conference centre and a programme of webinars and screen recordings. The emphasis on independence caused some confusion and it was challenging keeping the students on track, but the work produced demonstrated high levels of originality and creative thought. Some of the students' work included poetry, videos, photography and a social enterprise that won the award for 'Student Entrepreneur of the Year' for 2012.

The project was open to all students at UCBC who were taking either foundation or bachelor degrees and in some cases their work was submitted as summative assessment for their course of study. In these cases the students were provided with an alternative assessment question that had been through UCBC's standard quality assurance process. The open nature of the project meant that other students engaged in order to acquire formative assessment of some of their work for dissertation or research methods.

Source: Correspondence with Philip Johnson (P.Johnson@blackburn.ac.uk); http://communitychallenge.pbworks.com

5.2 Theme-based Interdisciplinary research at Harold Washington College, Chicago, USA

Harold Washington College, one of the City Colleges of Chicago piloted an interdisciplinary undergraduate research project during the spring and summer semesters of 2013. City Colleges offer a wide range of access programmes including academic programs enabling transfer to four year colleges.

The focus of the research was the Chicago Waterways. Faculty members in Art, Biology, Chemistry, English, Library Science and Physical Sciences (Geology) and the Vice President of Academic Affairs worked with 17 community college students. Each faculty member worked with 2-3 students to do independent research about the Chicago Waterways. These students were either in their second or third semester and were nominated by the seven faculty members who participated. There were not specific criteria for selection (grade point average, semesters competed, etc.). The main criteria were students who showed passion for the subject matter and interest in participating.

Seventeen Harold Washington College students conducted research related to art, biology, chemistry, English and more for the Chicago Waterways Research Project. This interdisciplinary research learning community spent two semesters researching and learning about the Chicago River together. The students were guided in their research projects by faculty members in a variety of disciplines and learned how to conduct research in those different academic areas. This two-semester project culminated with a poster session where each student presented their final reports to faculty, staff and the college community.

In addition to doing the independent research with their faculty members, the entire group of students, faculty, and administrator met weekly in a variety of learning opportunities. Each of the faculty members presented a lecture and research based on their past experience and expertise. Several guest lecturers from other City Colleges and area research universities were invited to present as well. The group also received lectures from area non-profit organizations including The Friends of Chicago River and together visited linked museums and organisations,

This pilot project has demonstrated that having an interdisciplinary, thematic approach coupled with structure weekly meetings, provided an engaging way for students to learn from a variety of discipline-specific perspectives, in an efficient and scalable way. The model is scalable because it leverages the experience of each faculty member to be used for the entire group and the weekly meetings are organized for all for all of the students so that each faculty member is only responsible for one session per term. This provides more time for the faculty member to mentor the student on the independent research projects. The administrator handles all logistical issues, created an email listserv for easy communication, and also updates the Web site. Based on the success of this pilot, plans are underway to institutionalize undergraduate research at The City Colleges of Chicago. The faculty and administrator on the project have reached out to faculty leadership across the District and will present their model at the District Faculty Development Week in August. In addition to the thematic learning community undergraduate model, Faculty will develop a standalone undergraduate research course that can be coupled with other general education courses to integrate research in other courses as well.

Sources: Correspondence with Margaret Martyn (mmartyn1@ccc.edu);
http://hwcollege.wordpress.com/chicago-waterway-research-project/;
http://hwcollege.wordpress.com/chicago-waterway-research-project/chicago-waterways-calendar/;
http://www.chicagoriver.org/education/

5.3 Developing research led ability to discuss concepts in the training, welfare and husbandry of horses at Hadlow College, Tonbridge, Kent, UK

This activity formed the major part of a year two module at Hadlow College. The students were a FdSc/BSc group who were co-taught in a module called 'Stresses in the Sports Horse' and the activity followed the development of journal reading, evaluation and a developing understanding of critical thinking skills in related modules. It allowed students to develop their ability to discuss and debate topics which may have been outside of their respective experience and experiences so that they could present a cogent argument, listen to others and develop points raised in preparation for careers in the equine industry where they may need to challenge long held beliefs, practices and traditions in favour of the use of new scientific understanding.

The module was organised so that each week was a discussion led activity. The students were provided with a statement at the end of one week and asked to research it using peer reviewed information and then come back and discuss it the following week. An example of a weekly topic would be: "Horses that are stable kept develop vices and behavioural problems over and above those that are paddock kept". The summative assessment topic was *".... never before have there been so many riders, such good quality riding horses, such fantastic organisation and capital*

available for funding in the equestrian sports as there are today. If we could only manage to train and test all horses according to old, time-proven and animal-friendly principals, our sport will become the most beautiful of all" (Heuschmann 2009, 125). This allowed for many of the module outcomes to be addressed.

The whole group were divided into 'virtuous circles' for this activity where 5-6 would be seated in a circle of chairs and 2-3 would then be standing outside the circle. Only those inside the circle could contribute to the discussion and if those outside the circle wanted to contribute they had to tap another student 'out' and take their place to make their point. This allowed students who were more reflective to not feel unduly 'forced' into discussion, those who were more verbal would tap more often (a limit was sometimes imposed so they had to really choose the right moment to use a 'tap'). The final assessment was also based on this activity alongside a written reflection of their part in the discussion. Both elements were assessed and guidance was given on how to reflect actively using the Ghaye model (2010). This module scored the highest for student satisfaction (94% - 81% last year) and the overall mark was also increased from a mean last year of 62% to 66% this year.

Sources: Correspondence with Stuart Atwood (stuart.attwood@hadlow.ac.uk);
http://www.hadlow.ac.uk/courses/equestrian-studies/bsc-hons-equine-management

6 Institutional

6.1 HE student research conference at Newcastle College, UK

Newcastle College is committed to valuing and celebrating student scholarship. The institution recognises that a large proportion of our students enrol pre-equipped with a high level of knowledge derived from experience in employment. The vocational nature of our HE provision ensures that students produce final projects and dissertations which have the potential to inform or enhance industry practice.

Discussions with students indicated that they often perceived their research to be of minimal interest to a wider audience and, in a few instances, failed to recognise the value of research skills for their future progression plans. Newcastle College has therefore established a dedicated HE Student Conference, which will showcase and celebrate undergraduate years 2 and 3 (levels 6 and 7) student research from across the institution. The event has been organised as a collaborative endeavour by staff from the HE Directorate and a student organising panel representing a range of disciplines. Student representation ensured that the event has been shaped to meet their expectations. Placement students enrolled on our FdA Events Management programme were also involved in assisting with planning for the event.

The HE Student Conference in 2013 was held shortly before the Graduation Ceremonies. The event featured academic papers, performances and poster presentations. Particular highlights included the launch of the business student-led *Seven Bridges Management Journal* (see Case study 2.3) and a presentation by two students who were recently awarded a £25,000 start-up loan to fund their theatre company. Pre-HE Level 3 students were invited to attend in order to enhance their understanding of the College's HE offer. Some of their FE students who hope to progress to HE were involved in photographing and filming the event to gain further experience of professional practice. It is hoped that the HE Student Conference will become an annual event.

Sources: Jonathan Eaton jonathan.eaton@ncl-coll.ac.uk;
http://www.ncl-coll.ac.uk/higher-education/research-and-scholarly-activity

6.2 Librarians support development of research skills with foundation degree students at University of Sunderland, UK

University library staff collaborated with a college lecturer on a pilot project at Bishop Auckland College, a franchise college, to develop two online workshops with foundation degree students taking courses in Education & Health and Health & Social Care. The students study part-time and are working in vocational settings which link closely with the course content and objectives. As such, they have practical experience in solving complex problems. The workshops were designed to draw upon this experience and help to forge the link between work and study.

Using *Vyew*, the online collaborative web conferencing tool (http://vyew.com/s/), online rooms were created to embed problem based activities which would align with the curriculum. The features of Vyew encourage active learning and participation by providing an interactive whiteboard, editing tools, instant chat and virtual sticky notes which can be used to provide instant feedback. The rooms remained available following the live session for reference and to promote further learning.

The first workshop focused on in-depth exploration of research topics and finding relevant information sources. Three activities were designed, the first of which used a mind-mapping tool to help identify keywords and themes in chosen topics. The second activity involved the identification of appropriate tools to find sources and then searching for literature in four key areas of theory, professional practice, academic research and legislation/policy.

The focus of the second workshop was on how the information sources could be effectively used in assignments. Three further activities were designed; the first applying a range of critical questions to one of the sources; the second, an exercise in defining plagiarism, leading to the third activity on paraphrasing and summarising. Groups were given an extract from an article and asked to highlight key points, then write a brief summary in their own words.

Evaluation of the project is ongoing but initial feedback has led to adoption of the workshops for the 2013/14 academic year by all partnership FE colleges who run one of the two programmes.

Source: Stevenson and Young (2013)

Case study 6.3 Institutional Research office supports local economic development and student research at Holland College, Prince Edward Island, Canada

The Applied Research Department at Holland College supports economic development for Prince Edward Island by solving technical and business problems for industry and community clients utilizing the college's expertise and facilities while enhancing the quality of college programmes. The research undertaken is focussed on key areas closely linked to the college curricula particularly Social Innovation and Science and Technologies.

A central way that this 'external' research feeds into the curriculum is through the Applied Research Department supporting capstone projects that are a key feature of the two year applied degree program. Through its links with external local clients the Research Department provides the contacts and expertise for students to undertake a significant applied research capstone project. Two examples follow:

The two year ***Applied Degree in Culinary Operations program*** has a required practical, community-based research project in their final year of study. As part of the *Directed Foodservice Study* course, students conduct research in the foodservice industry within the Culinary Institute of Canada faculty and under employer supervision. The planning process (proposal development) for this research

project takes place earlier in the program as a result of work completed in a course titled, *Food Service Study Seminar*. In the students' final year of study, they are expected to submit a project proposal by late fall so that their projects can be approved by faculty, the Applied Research department, and the Holland College Research Ethics Board. Research is timed to start in early January. Through the research process, students work independently with guidance from a faculty advisor and an industry liaison. The research projects enable students to implement new skills as they work to meet industry needs. Students are exposed to the entire research process from proposal and ethics application writing, to carrying out the actual project, compiling a report and finally preparing a presentation for a panel of experts. These applied research projects teach students how to carry out a project from start to finish, as well as offering networking opportunities between students and industry partners for potential future employment.

As a part of the two year ***Energy Systems Engineering Technology program***, students are given a choice between completing on-the-job-training or conducting an applied research project with an energy company. If they choose the latter they complete individual applied research projects as a part of the *Capstone Project* course in the students' final year of study. The projects focus on energy efficiency and renewable energy and can include information on consumer needs, habits, alternative energy sources, and recommendations. Students focus on the technical aspect of the project and are required to submit a proposal, write a report of their findings and present the final results to the class.

Sources: Correspondence with Audrey Penner (APenner@hollandcollege.com); https://www.hollandcollege.com/applied_research/index.php; https://www.hollandcollege.com/admissions/full_time_programs/applied_degree_in_culinary_operations/; https://www.hollandcollege.com/admissions/full_time_programs/energy_systems_engineering_technology/

6.4 Developing student research in science and technology at Georgia Gwinnett College, USA

The college is a four year degree institution founded in 1996 now with 9,000 plus students. In the early years few faculty were involved in research and relatedly there were few opportunities for students to conduct research in their courses or in special undergraduate research programmes. The School of Science and Technology has developed a range of initiatives to support research by students and staff. In 2009 a multidisciplinary introductory research course was introduced that was appropriate for students in all STEM programmes. To graduate in science or technology students have to complete an undergraduate research project or internship in their senior year. To support this a web site was developed that listed all the available opportunities for students to carry out research and faculty research interests. In 2010 the Faculty convened the first Science, Technology and Research Show that highlighted the research done by students and faculty. In 2011 a 'meet and greet' event was initiated where students seeking research opportunities could meet faculty and learn what research they might be become involved with. In 2011 the degree programmes were reshaped to ensure that students were better involved in research based coursework throughout their four year programme. For example, authentic research experiences were introduced into 17 courses, nine of which were at the freshman and sophomore levels. This approach to embedding research in the undergraduate curriculum has supported the growth of the scholarly output of both students and faculty.

Sources: Sloop et al. (2013); http://www.ggc.edu/academics/schools/school-of-science-and-technology/docs/stec-4500-syllabus.pdf; http://www.ggc.edu/student-life/events-calendar/events-calendar/event/04/09/2013/L-Building%20A/T-science%20and%20technology/K-stars/stars-the-sciend-technology-and-research-show

6.5 Institutional supported community based research Penn State Brandywine, USA

Brandywine is one of the twenty campuses of the Pennsylvania State University system. Its primary mission is providing two year entrance to disciplinary four year courses at other institutions – in particular the nearby Penn State. The institution is small, not well resourced, lacks equipment and does not have any graduate students who commonly play a supportive role teaching undergraduates in other institutions, yet over the years student involvement in research and inquiry has been embedded in a wide range of year one and two courses. Shaped by US conceptions of the 'scholarship of engagement' (Boyer 2000), a central feature of the formal curriculum and student and staff volunteering is a range of courses and projects that involve staff and students working and researching with community partners on issues of community concern.

A particular feature of the formal curriculum is the Intercollege Minor in Civic and Community Engagement (in many US institutions students have a central focus on one discipline – their major – but they may well take a significant but smaller number of courses in another discipline – their minor). Program faculty, drawn from across the University, encourage, recognize, and systematize student participation in public service or problem-based fieldwork and research. The minor culminates with an approved capstone project. This may be a significant paper, or annotated portfolio, or other demonstration of substantial reflection upon and integration of the minor experience and the broader issue of application of academic theory and practice in the civic community.

Sources: Guertin and Esparragoza (2009); http://www.brandywine.psu.edu/; http://engage.bw.psu.edu/; http://brandywine.psu.edu/Academics/Degrees/civcom_minor.htm; http://brandywine.psu.edu/Information/Community/outreach.htm

6.6 Partnering with four-year colleges to support community college student STEM research and transfer opportunities in Chicago, USA

Our collaborative consists of ten Chicago-area community colleges and a growing number of four-year colleges. We work together to recruit and train students for summer research opportunities in the STEM disciplines in the belief that these experiences will incite a passion for science and help ease student transitions from the community college. We recruit from urban and suburban community colleges and a majority of our students come from underrepresented groups, including women, first-generation college students, and ethnic minorities. During the academic year, students enroll in research training courses taught by community college STEM faculty. Here, students learn the skills and habits of science, which prepare them for full-time research projects during the summer with our partners at four-year colleges and universities. We begin preparing students for this transition by actively building community and by hosting three annual poster sessions where students present their research and faculty recruit for the summer programs. In addition to mentoring students while they are doing summer research, the four-year college faculty also help students with the transition from a two-year to a four-year environment. Our program assessment shows students make quantifiable gains in critical workforce and research skills, confidence in their academic abilities, and enthusiasm for pursuing a career in STEM. Over a five-year period, 286 students have participated in the program. Almost all (96%) have completed the academic year program, which consists of both research in the lab and activities to build communication and collaboration skills. Almost half of the students (47%) have done summer research, and over half (54%) have transferred from the community college to the four-year college to complete their undergraduate degrees. Many of the students in our first and second cohort have gone on to graduate school.

Sources: Correspondence with Thomas Higgins (tbhiggins@ccc.edu); Higgins et al. (2011); Higgins (in press).

6.7 Engaging honors students in research at Valencia College, Orlando, USA
Valencia is a two year public community college with a high number of students transferring to the linked University of Central Florida. It benefits from strong endowment support from local industries. In 2012 it launched the Research Track for Honors students (in the US system honors is for selected students with high grades). This track requires both a curricular and co-curricular (ie outside the formal curriculum) components to their degree. The plan includes a 2-credit course introducing them to the process of research including tools and resources necessary for them to successfully analyze and use information leading to honors research. There is also a study plan for students to select honors courses (12-15 credits) designed to enhance their research plan.

The capstone is an Honors Project that is completed under the guidance of a faculty advisor. It involves a research project following specific formatting requirements of the discipline. Students present their research to a board of their Faculty Advisor, Honors Director and small group of peers. They are to be prepared to not only present, but respond to questions from the board much like one would expect in presenting a thesis or dissertation.

The co-curricular component is participation in presenting original research at Valencia or conferences, or participating in the editing and publication of an Honors research journal. Opportunities to attend undergraduate research conferences are also provided. A student research community was also established to encourage research for all students, honors or not. It provides workshops related to research, guest speakers from a range of disciplines and an opportunity to work with like-minded students.

Sources: Correspondence with Diana Ciesko (dciesko@valenciacollege.edu); http://valenciacollege.edu/learningcouncil/documents/CLCDraftMinutesPacket11.4.10.pdf; http://valenciacollege.edu/; http://en.wikipedia.org/wiki/Valencia_College

6.8 Faculty development program at Valencia College, Orlando, USA
Valencia is a two year public community college with a selective undergraduate research program (Case study 6.8). A teaching development program is open to all staff (faculty).To successfully complete the program, the faculty member must complete a minimum of 8 hours in two foundational courses, 6 hours in honors pedagogy courses, and 6 hours in optional learning opportunities. These courses include many that are focussed on helping faculty to support student research and inquiry. Those taking this course are financially supported to attend selected disciplinary and pedagogic conferences.

Sources: Correspondence with Diana Ciesko (dciesko@valenciacollege.edu); http://valenciacollege.edu/faculty/development/; http://valenciacollege.edu/faculty/development/programs/SeneffCert.cfm

7.   National

7.1 Community College Undergraduate Research Initiative: A national STEM consortium at Finger Lakes Community College, Canandaigua, NY, USA

The Community College Undergraduate Research Initiative (CCURI) is a national consortium of community colleges, four-year schools, government agencies, and private organizations dedicated to the development, implementation, and assessment of a sustainable model for integrating an undergraduate research (UR) experience into a community college biology curriculum. In partnership with the Council on Undergraduate Research (CUR), CCURI has developed a model for

fully integrating undergraduate research at a community college. The model elements focus on the unique barriers that these institutions face as they work toward comprehensive curriculum reform.

The CCURI uses an inquiry-based teaching model where students are exposed to real world science through a case study in an introductory course followed by a hands-on research experience resulting from questions about or related to the case. CCURI is providing resources for institutional partners including introductory workshops and conferences that are building regional and national collaborations, start-up supplies, and a wide variety of faculty development opportunities. CCURI currently supports 32 Community College partners throughout the United States. The goals for the final phase of CCURI's development are to:
1) Expand a modified version of the CCURI model to 26 additional community colleges;
2) Implement a comprehensive evaluation of the CCURI model on student learning, competency, and retention in Science, Technology, Engineering and Mathematics subjects;
3) Measure the impact of the CCURI model on developing institutional capacity at the 26 additional community colleges that are committed to developing an undergraduate research program; and
4) Disseminate the modified CCURI model of integration and the customized versions of the model as they exist at the institutional partners within CCURI.

Sources: www.ccuri.org; http://chronicle.com/article/With-NSF-Support-Research/130339/; http://www.ccweek.com/news/templates/template.aspx?articleid=2957&zoneid=7; http://www.communitycollegetimes.com/Pages/Academic-Programs/Research-projects-spur-student-engagement-in-learning.aspx; http://www.sciencemag.org/content/333/6049/1572.summary

Case study 7.2 The Council on Undergraduate Research (CUR) supports community based undergraduate research in the USA

CUR supports undergraduate research across the diverse US higher education system and is supported by institutional contributions. It has a wide range of programmes and activities at national level and supports regional and local activities which bring students into the worlds of research. These activities include specific initiatives re the college sector including conferences, special publications (eg Cedja and Hensel 2010), disciplinary resources and a range of funded projects – often funded through bids to the National Science Foundation (Case study 7.18).

Sources: www.cur.org; www.cur.org/projects_and_services/special_projects/community_colleges/

Case study 7.3 The Higher Education Funding Council for England (HEFCE) supported the development of research-informed teaching environments, with funds allocated *inversely* proportional to an institution's research funding in England, UK

In March 2006 HEFCE announced additional funding to support research informed teaching (RIT) to be allocated in inverse proportion to an institution's research funding. This was part of HEFCE's Teaching Quality Enhancement Fund. £40m was allocated over three years. The division between which higher education institutions (including FE Colleges with over 100ftes in HE level work) received funding and those which did not, largely mirrored the old/new university and college divide. HEFCE (2006, 6-7) stated that:

Areas where institutions could invest funds included:
- keeping the curriculum up-to-date and active, effectively supported by appropriate learning resources linked to recent research

- ensuring that courses are designed in ways that support the development of learning outcomes appropriate to the knowledge economy, including appropriate pedagogy – that is, students experiencing research, and developing research skills

Sources: webarchive.nationalarchives.gov.uk/20100202100434/;
www.hefce.ac.uk/whatwedo/lt/howfund/supportforteachingenhancement/

Case study 7.4 National Science Foundation (NSF) established the Undergraduate Research Collaborative Program which sought to include first and second year college students, USA

The Undergraduate Research Collaboratives (URC) Program funded in 2006 sought new models and partnerships with the potential (1) to expand the reach of undergraduate research to include first- and second-year college students; (2) to broaden participation and increase diversity in the student talent pool from which the nation's future technical workforce will be drawn; and (3) to enhance the research capacity, infrastructure, and culture of participating institutions. This program has helped stimulate a range of initiatives and funding schemes by the NSF to support undergraduate research including primarily undergraduate institutions

Each award provided approximately $3-million over a five-year period. The projects provided blueprints for research-oriented curricula for thousands of first- and second-year college students. An initial award, for a project led by, The Center for Authentic Science Practice in Education, Purdue University, includes nine academic institutions in Illinois and Indiana (www.purdue.edu/discoverypark/caspie/). As of 2012 the success of such programmes has resulted in a range of NSF programs to support undergraduate research including programs aimed at primarily undergraduate institutions to promote a more diversified undergraduate population and diverse research workforce.

Sources: www.nsf.gov/pubs/2006/nsf06521/nsf06521.htm;
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