Session Abstract

Research-based learning (RBL) is evident where students are engaged in authentic enquiry processes. The benefits to students of this mode of learning include increased engagement, fostering of critical thinking and greater independence. Staff are often inspired through their involvement in RBL, particularly staff who can use this approach to strengthen the connection between their research and their teaching. For universities and policy makers this mode of learning and teaching has the potential to meet wider societal needs, through its emphasis on equipping graduates with the attributes needed to address complex global challenges. The session will share case studies of good practice to embed RBL in curricula. Participants will have the opportunity to discuss how these approaches might work in their context and contribute their own practices. The ultimate goal of the session is to explore ways in which we can enhance approaches to embedding RBL into curricula.

Additional note: this approach to learning is endorsed by the European Standards and Guidelines for Quality Assurance (ESG 2015) which recommends in Standard 1.3 that: '*Institutions should ensure that the programmes are delivered in a way that encourages students to take an active role in creating the learning process, and that the assessment of students reflects this approach*'.

Worksheet contents

1: Our working group

The EUA Peer Group on Research-Teaching links featured staff and students from 8 different institutions[1] with an interest and expertise in helping bring together the research and teaching missions of Higher Education. The group identified three keys challenges relating to improving the link between research and teaching.

- Ensuring parity of esteem for research and teaching in academic life

[1] Humboldt University of Berlin, Pierre-and-Marie-Curie University, University of Sheffield, Sapienza University of Rome, Pompeu Fabra University, Silesian University of Technology, University College Cork, University of Borås

- Shifting the focus of research-enriched curricula towards growing an inquiry mindset and related skills amongst students
- Finding spaces and opportunities in curricula for research-based teaching and different teaching approaches for engaging students with research

This workshop is focussed on the opportunities for embedding research-based learning in the curriculum which include both curricular approaches and supportive strategies and policies. The students participating in the broader peer-group discussions created a video recounting their experiences of research-based learning which was launched at the inaugural EUA Learning and Teaching Forum, September 2017. The video can be accessed from following link: www.youtube.com/watch?v=Rb5CH9P_wD0

2: The benefits of RBL

Our Peer Group report provides our definition of research based learning, which we would like to share with you as a reference point and to help foreground our examples.

> ***Research-based learning (RBL)*** is an approach by which students are actively engaged in inquiry and research. The curriculum contains activities in which students conduct research or engage in authentic processes of inquiry. This can include the development of students' research skills through engaging in research methods courses, or problem-/project-based learning methods and include real cases of analysis and solution. While there are different interpretations and models of RBL, they all share an emphasis of *active acquisition of skills and knowledge through research.* Consequently, academics involved in RBL play the roles of mentor and research project leader, and also serve as examples of how to integrate research and teaching in academic life.

The broad spectrum of approaches which can be characterised as research based learning is in part attributable to disciplinary contexts and modes of research. However, through the literature and the practices we shared, our group concluded that it is possible to identify approaches which optimise student engagement and learning, and are more effective in integrating staff experiences of the teaching and research dimensions of their work, regardless of discipline. In summary, the approaches we want to promote more widely have the following characteristics: student enquiry and capacity to engage in research practices drives curriculum development and assessment strategies; the learning environment situates students in a wider research community, with opportunities to work collaboratively with staff and peers; the curriculum provides authentic learning experiences which mirror research in practice, so including work beyond disciplinary boundaries to tackle common or global challenges; students have opportunities to work beyond the walls of the university, in keeping with the driving purpose of research to make a difference in the world, and with opportunities to communicate the outcomes of research to diverse audiences which might include other students, academics, external partners, local communities and employers.

With respect to these optimum approaches we identified a number of implications and challenges for curriculum design and delivery:

- intended graduate outcomes and appropriate skills development to scaffold student progression through the programmes need to be embedded and clearly articulated at all levels of study. However, our experiences illustrate that students do not always recognise the value of this development and might prefer to focus on content, particularly in the early stages of undergraduate study. This could prove a disincentive for staff if it negatively affects student evaluation of learning and teaching;
- student participation in research projects with staff or student teams can be resource intensive, in terms of participants' time and access to the appropriate spaces and materials, such as labs. Team based work has additional implications for the development of 'soft

skills' and considerations for the role of peer evaluation and assessment, all of which require planning and scaffolding;

- authentic assessments require the use of varied assessments, for example presentations, posters and multimedia as opposed to a 'traditional' essay or written exam, and this has implications for staff development and can be challenging for students if they are being asked to produce an output which is more challenging, and therefore riskier, than a more familiar format;
- external input and engagement, for example, opportunities to work on community based development projects or undertake research projects with industry and present the outcomes to relevant audiences can enrich student engagement and learning. However, to achieve this requires sustainable models for partnership working between the university and external organisations, and is be inherently higher risk than desk based research for the learner and the teacher;
- there are implications for inter-disciplinary working, and the balance between individual and team based learning, which present challenges to the constraints of programme structures, timetabling and teaching spaces;
- student outcomes need to be appropriately recognised and rewarded, either through credits or a formal approach to recording extra or co-curricular learning achievements, e.g. in a student/graduate transcript;
- for academic staff, there is an impact on the role of the teacher - moving from content delivery to mentoring/scaffolding in a student-centred learning environment; managing student expectations; taking a holistic approach to student development; providing Incremental exposure and engagement in research based learning. This requires staff development, opportunities to develop and share their practice and institutional approaches to recognition and reward which promote and valorise effective RBL are critical. This topic was explored in more detail by our peer group under the 'parity of esteem' theme;
- there are implications for alignment with other drivers such as professional accreditation or national subject benchmarks and curriculum standards.

The range of considerations we identified underlined that institutional strategies and allocation of resource are critical in promoting and sustaining the most effective practices. To promote sustainable innovation, it can be beneficial to take a multi modal approach. Examples we identified include: institution wide approaches, such as curriculum mapping against a university framework and provision of centres with a remit to foster and share good practices; mechanisms for identifying excellent teachers and sharing their practice more widely; and pump priming of small scale developments to foster innovations with an emphasis on identifying transferable and scalable outcomes.

Figure 1 captures the discussions by the peer group on approaches for embedding research-based learning in the curriculum. Curricular approaches are named in the middle with due consideration of how best to scaffold these approaches. Co- or extra-curricular approaches are provided at the top and the additional benefits to students at the bottom of the circle. Key pedagogies that can provide space in the curriculum to enable research-based teaching and learning are listed at the side. Finally, the entire curricular and co-curricular elements rest upon appropriate institutional, infrastructural and policy supports.

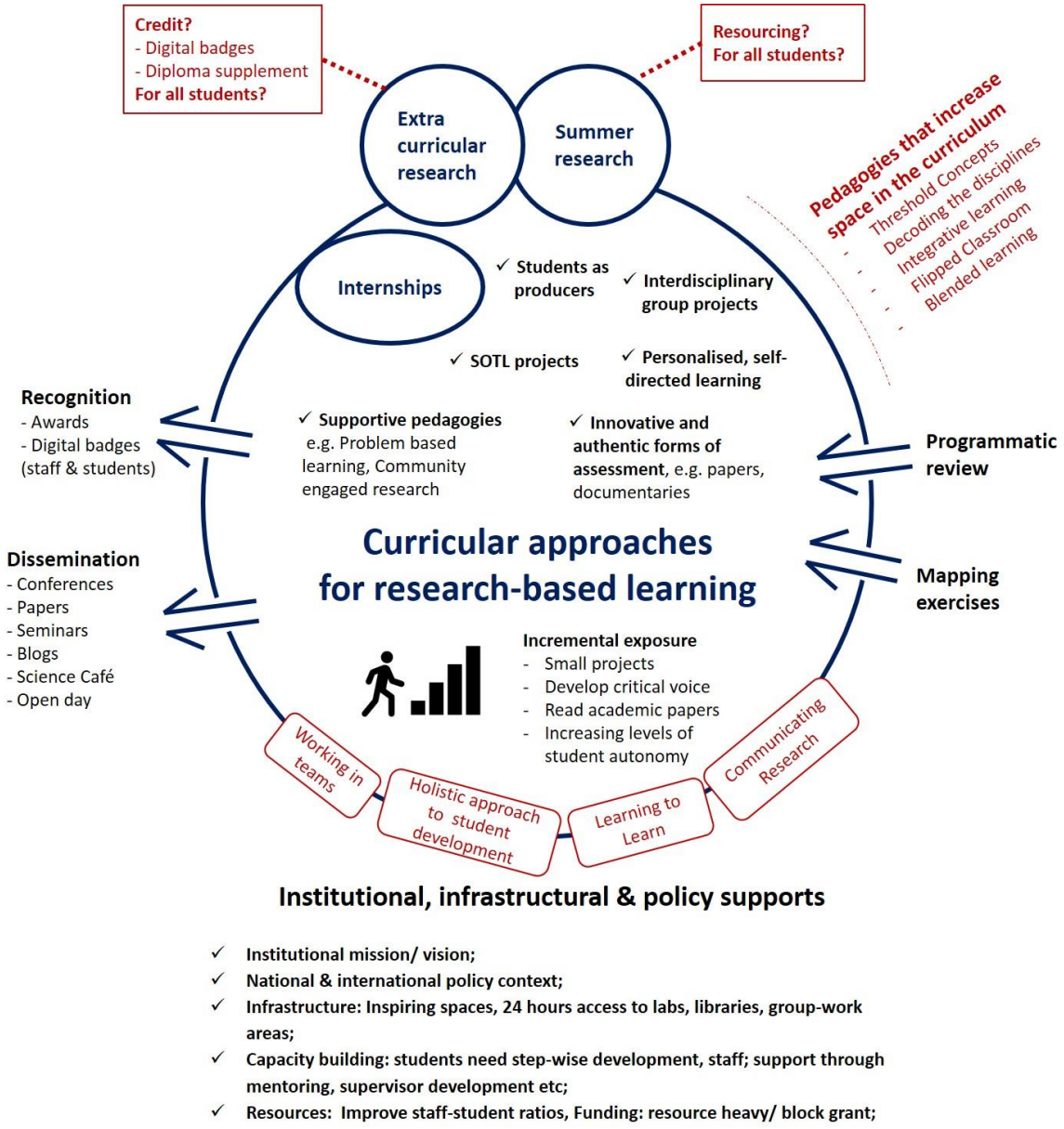

Figure 1: Approaches for embedding research in the curriculum

3: Inspiring practices

We have collated a selection of examples of practice shared through the course of our work. These represent the range of approaches we found to be inspiring and in keeping with the criteria we had identified for best practice. They also shed further light on the implications for sustainability in developing effective curricula, including staff and student engagement and institutional support and infrastructure, and some of the ways these challenges can be addressed. We recognise that every university has its own mission and culture, and there are national policy and funding drivers which impact on what is feasible, so the intention here is to open-up possibilities rather than suggest that there is a one size fits all approach to effective curriculum design for effective RBL.

3.1 Curriculum Innovation: Making Space for Undergraduate Research

Core Skills Development and the use of FabLabs, University Pierre and Marie Curie
All first year students have lab based training, designed to equip them with both the research and soft skills needed for engagement with research based learning. Student evaluation shows that students recognise the importance of being equipped with lab skills, but are less clear that they will use the range of skills gained throughout the course of their studies. This underlines the need to make academic and personal skills development explicit throughout the curriculum to ensure that students can build on each level of study.

To enhance RBL the University has invested in FabLabs, a digital fabrication and prototyping laboratory where students can develop their own personal research projects. This model was developed by MIT, and UPMC is committed to implementing the labs in keeping with the original ethos and practice. The UPMC FabLab is equipped with standard tools, is collaborative and open, gathers a multidisciplinary community, promotes open-source and open-hardware.

The labs are kitted out to a high specification and provide student access to equipment outside of their core curriculum. However, they provide more than a collection of tools. The Labs provide space of students to work beyond their discipline and year cohorts, and with a range of academic staff. Last year 480 students participated, three quarters coming from the second, third and fourth years, and all subjects were represented.

The Labs also provide a space for student led initiatives and projects with external organisations, e.g. JuniorConseil (https://www.juniorupmc.fr/), PMC Entrepreneurs (http://pmc-entrepreneurs.com/). The model is scale-able, is in keeping with the UPMC approach to RBL, and provides opportunities for students to extend their learning through working beyond their core curriculum and with an extended peer group.

Directed Study Programme, Sapienza University of Rome
A Directed Study is an academic course that provides a more in-depth and comprehensive study of a specific topic. The directed study programme is open to Arts and Humanities International Exchange students and postgraduate students at Sapienza University of Rome, who are required to complete independent research or fieldwork under the guidance of a faculty member. The course may also include other additional assignments and the production of a final paper or a series of shorter ones. Academic assignments are mutually agreed upon between the student and the supervising faculty member and are completed in English. Graduate students may also present an independent research proposal or plan of study outlining the goals and objectives of directed study, to any of the faculty supervisors.

An exchange student may decide to take a directed study course to learn more about a topic or course that he or she has already studied. Moreover, directed courses also allow students, who do not have the necessary fluency in Italian to follow standard university courses, to learn more about topics related to Italian history and culture.

Each directed study course included in this programme is tailored so that a student can earn up to six credits per course.

This work includes:
1. Meetings with the supervising faculty member;
2. Reading;
3. Research or field work (where the case applies);
4. An appropriate number of written pages (either one lengthy essay or a series of papers).

See: http://en.uniroma1.it/node/12806/directed-study-programme-arts-and-humanities-international-exchange-students

3.2 Curriculum Innovation: Working Beyond the University

Engaged Learning, University of Sheffield
The University's leaning and teaching ethos and strategy is committed to preparing graduates for making a difference in the world, whether that be through work, research or how they contribute to their local community. This reflects the drivers for research and is a critical component of the University's approach to RBL. In a number of disciplines this has involved working outside the university, bringing together students, community groups, employers and users of local services to work on projects for example the FreeLaw legal advice clinic in the School of Law, The School of Architecture's Live Projects and Storying Sheffield in the School of English.

The university established the 'Engaged Learning' initiative to provide a framework and models for extending the scale and reach of this model for RBL. The initiative has been led by an Academic Director, Professor Brendan Stone, and has encompassed: establishing and sharing good practices in curriculum development for engaged learning, for example, through pump priming of projects, sharing case studies and a teaching network; providing guidance and a framework for establishing and sustaining effective working with external partners; and gaining further insights on the benefits for student engagement and learning.

Through participating in engaged learning projects, students acquire skills and experience which enhance their employability, and their personal and professional development. Skills which are developed through engaged learning include: team working; the ability to be flexible, resilient, and responsive as projects evolve in unexpected ways; project management; leadership and enterprise; and independent learning.

Engaged learning and teaching frequently arises from or aligns with academics' research, and involves working on a 'live' question or issue which is unresolved. Participating students usually undertake their own personal research projects which offer the genuine possibility of producing new knowledge or devising new solutions. Engaged projects frequently operate as communities of learning in which students, staff, and community partners work and research together. Because of students' role as co-researchers and partners, they are frequently engaged in the development and direction of learning and teaching.
See: www.sheffield.ac.uk/als/current/engaged

Community-engaged Research, University College Cork
The Community-Academic Research Links initiative (CARL)at University College Cork is based on the European "Science Shop" model, and was one of the first of its type to be established in the Republic of Ireland. CARL invites non-profit voluntary or community organisations (Civil Society Organisations CSOs) to suggest potential research topics that can be pursued in partnership with students across all academic disciplines. On selecting a research topic, the student, supervisor and CSO representative come together to discuss and agree the focus and scope of the research, facilitated by CARL staff. In some cases, the proposed research question needs to be expanded so to ensure the academic requirements of the student researcher are fulfilled. In other cases, the proposed project may need to be phased over several years or involve a few students. The student conducts the research as part of their course work. The partnerships vary from contractual to the truly participatory depending on the availability of the community partner and the focus of the research project. A key final step in this process is the sharing of the research findings in a readily digestible format and working with the community partner to identify potential next steps arising from

the research. This ensures that students not only orient their research towards addressing real-world problems, and that they work in partnership with community groups, but that the community partner can use the findings to affect change.

University College Cork will launch its inaugural Civic and Community Engagement plan in December 2017. The five-year plan sets out an ambitious goal to become more *Connected, Visible and Engaged with and for Community*. To reach this goal, the plan calls for new commitments in physical and organisational infrastructure, teaching and research. These commitments promise significant positive impact on UCC's academic, research and teaching environment, and crucially, its relationship with the community.

See: https://carl.ucc.ie

3.3 Curriculum Innovation: Interdisciplinary RBL

Facilitating Interdisciplinary Learning, Pierre and Marie Curie, Paris Sorbonne
UPMC has research expertise in Science, Technology, Engineering and Medicine, has identified that inter-disciplinary approaches are closely connected to models for effective student-centred RBL**.** However, this has raised a few questions for the institution, including:

- How can students be incentivised to use their disciplinary skills to go beyond their discipline?
- What would that mean to them in terms of professional identity, working in collaboration, and demonstrating their achievements?
- How can the programme structures enable interdisciplinary learning?

All undergraduate students can now choose at UPMC a bachelor's degree in a single area of study, a major/minor program with two fields, or a reinforced double major with two degrees. With respect to the implications for research experience, the FabLabs initiative, see above, has provided a sustainable model for inter-disciplinary practice in lab based research.

The forthcoming merger with Paris-Sorbonne University provides the opportunity to extend the minor program to the field of humanities. It is intended that students of the resulting institution called "Sorbonne Université" (which will open its doors on next January) will be able to participate in research projects mixing STEM and liberal arts, based around societal problems and aligned with research institutes and networks (Institute of Health and Engineering, Institute of Cultural Heritage, Past and Future, Institute of Data, Scientific Computing and Simulation, Institute of Environmental Transition, and Collegium Musicae),

10billion, *University of Sheffield*
The learning and teaching strategy commits to support 'working across boundaries', in particular providing opportunities for students to learn outside their discipline. An inter-disciplinary conference hosted in 2016 provided an opportunity to share and consider the challenges – for example student engagement with the benefits, supporting students in developing approaches and skills for working across disciplinary boundaries and in multi-disciplinary teams, and the organisational structures, systems and cultures which can stifle innovation in inter-disciplinary learning and teaching (www.sheffield.ac.uk/als/current/interdisciplinarity). A drive to work at programme level (Programme Level View) has the potential to address some of these challenges, in addition, the university has been exploring models for delivering inter-disciplinary learning activities at scale, including the use of digital technologies.
10bn is a three-week online course and is intended to be flexible enough that it can be incorporated within a programme of study or taken as an additional activity. The course explores current research taking place at the University relevant to the meeting the

challenges that come with a growing global population (10bn). Topics covered include: the way migration is represented through media and art; the challenges of an ageing population; the issue of social justice; how we tackle climate change; how we ensure food security for the future.

The course is currently hosted on the FutureLearn platform, which provides the option of opening it up to learners beyond the university. The course material is structured by theme, and includes materials developed and produced with our research leaders in the relevant fields (for example introductory film, journal articles and links to web resources), alongside activities to support the student's engagement and learning through the course. The activities include individual responses and group based exercises which make use of the online community tools available. The course enables students to gain knowledge of the topics and an appreciation of the relevance of various disciplinary perspectives and approaches. In addition, it is designed to develop or enhance skills which are relevant throughout their studies, including: critical thinking, cross-disciplinary communication, peer review and evaluation and reflection.

Completion of the course is recorded in the students Higher Education Report (www.sheffield.ac.uk/ssid/hear). In addition, in 2016-17 the university offered participants the opportunity to apply for a bursary to undertake an inter-disciplinary summer research project through the Sheffield Undergraduate Research Experience Scheme (www.sheffield.ac.uk/sure/301 /).

See: www.sheffield.ac.uk/ssid/course/10bn

3.4 Curriculum Innovation: Programme Wide Initiatives

HU-Q Programme, Humboldt University

The Q programme at Humboldt University in Berlin provides the opportunity for research-based teaching and learning at Bachelor's and Master's level. Q stands for question, query, quest and qualifications, i.e. "to ask your own *questions*, to *query* that which is accepted as given, to go in *quest* of your own solutions and to gain experience and acquire *qualifications".* Students can engage in four different initiatives, Q-tutorial, Q-teams, Q-kollegs and Q-modules, but we will focus on the Q-tutorials and Q-teams initiatives.

Q Tutorials

Q-Tutorials are student-initiated and student-led research projects. It is an elective option, and open to all students across the University from first year on. Students competitively bid for research funding (effectively, one-year student research stipends worth about €6,200). Successful applicants are employed as 'tutors' and lead a student research team. The Q-tutor is supported to adapt their project to the principles of research-based learning and they also receive training in project management and group moderation. The tutorials run for two hours a week for one semester and the participants in the research teams receive academic credits for their work. The aim is to involve the participating students in a research cycle – from the development of the research question to the publication of the results. Typically, 36 Q-tutorials are offered each year with 6-15 student participants per team.

Q Teams

Q-Teams are projects linked to existing research taking place in Humboldt University and are initiated and supervised by PhD or postdoctoral researchers. The initiative is advertised both internally and to external research institutes in the Berlin area, and the successful applicant gets a teaching contract of €1,100-€2,200 over one or two semesters. The Q-team

leader coaches a team of student researchers. They are encouraged to translate their research interests into teaching, and they participate in professional development to prepare them to support research-based learning. For Q-Team leaders, the format offers a first experience of leading a (student) research group. For the students, participation in the Q-team ideally leads to them developing their own research questions leading to a project related Bachelor or Masters dissertation. Up to 22 Q-Teams are sponsored each year and the team is comprised of 5-10 students.

See: www.hu-berlin.de/en/institutions/administration/bolognalab/projekte-des-bologna.labs-en/q-programm/q-programme

Supervised Research Workshops, University of Pierre and Marie Curie
UPMC offers, a range of initiatives such as lab internships and the Fab Lab, and pedagogical approaches such as problem based learning to foster research and enquiry among its students. The "Atelier de Rechereche Encadrée" (ARE) initiative, which translates into supervised research workshop, enables all 2,700 UPMC first year students to engage in research from their entry into University. The students are supervised by teaching staff from two different departments and they work in transdisciplinary teams of four students. The programme runs in the second semester, is compulsory for UPMC students and is worth 6 ECTS. Documents relating to the research project must be posted on the Lab wiki. Students use the Wiki as a blog that they can embellish with photos or videos, and this allows the supervisors to follow their work.

See: http://video.upmc.fr/differe.php?collec=C_atelier_recherche_encadree-2014

3.5 Mapping Curricula and Promoting Effective RBL

Mapping Research across the Undergraduate Curriculum, University College Cork
University College Cork identifies itself as a research-led University and has stated the ambition to maximise opportunities for students to participate in research programmes throughout their undergraduate studies. A curriculum analytics project was enacted by staff in UCC to gather evidence of research-oriented and research-based teaching in undergraduate programmes offered to students via the CAO system in 2015/2016. The review showed that 55% of undergraduate programmes make explicit mention of research and inquiry in their programme learning outcomes. Analysis of module learning outcomes further showed that 45% of the reviewed programmes provide students with exposure to research-based or research-oriented teaching across the duration of their programme. The project provides an important baseline of existing research in the undergraduate curriculum, it uncovers exemplar activities across a range of subject areas and disciplines, and extends the vocabulary around research and inquiry to include discipline-specific approaches and understandings. Future work will include gathering feedback from staff and qualitative research with students to correct any inaccuracies in the data with a view to refining the search query and running a regular, more automated analysis.

See: www.ucc.ie/en/cirtl/resources/rtl/

Research-based Learning Matrix, Humboldt University
In an exercise very similar to that conducted at UCC, at Humboldt-Universität the Healey/Jenkins-matrix was expanded upon to account more accurately for a greater range of research-related learning activities. Of the 167 programmes reviewed, 564 modules made explicit reference to research and/or research related activities in the module outcomes and module descriptions. The Humboldt review also identified disciplinary of subject-specific

approaches to linking research and teaching and provides an entry point to further discussions with teaching staff on practical ways to engage in research-based teaching. The expanded matrix (Rueß, Gess and Deicke, 2016; Sonntag et al. 2016 (English translation forthcoming 2017) is now used in staff development sessions as an entry point for reflections on the research-related strengths and weaknesses of a single course or module as well as an entry point in joint departmental curriculum development activities. The aim here is to help teaching staff (or researchers engaged in teaching) to think more clearly through how and where they can facilitate the students' transitions from passive to active learning. The extended matrix allows staff to map themselves against the results of the mapping exercise and course teams to map their modules alongside each other, enabling them to identify areas of necessary overlaps, redundancies and gaps in the coverage.

www.researchgate.net/publication/308047837_Forschendes_Lernen_im_Seminar_Ein_Leitfaden_fur_Lehrende

3.6 Aligning Institutional Mission and Support for Innovation

Signposting a commitment to RBL at institutional level, University Pompeu Fabra
The University is relatively young, founded in 1990. The mission of the university encompasses research and teaching, and the strategy and structures for learning and teaching are predicated on promoting RBL:

- Students participate in research groups and projects at a very early stage
- The teaching methodologies include research-based learning dynamics
- The University is trying to make programmes more flexible to inspire teaching from research, sometimes through other non-standard courses
- The Final Studies Project is based on a research process
- There is inclusion of external agents, institutions and companies to foster real research problems in different disciplines
- Research is understood in a broad sense, including development, innovation and artistic creation and supported through the creation of Digital Labs for research and teaching

Examples include: bridging Humanities and Medicine in hospitals through problems and research-based learning; audio-visual formats experimentation in media in the Communication Department; Engineering pilots to solve social problems; Legal cases study and interaction in real environments.

Innovative practice is supported and promoted through the Centre for Learning Innovation and Knowledge. The Centre's remit includes: training schemes for teaching staff; promotion of innovation in pedagogy and the use of technologies to enhance learning and teaching, for example through innovation workshops; support for teaching projects and associated research including funded projects (PlaCick Grants); promoting engaged learning - social responsibility in teaching and research, including "*transfer to society of knowledge, skills and attitudes acquired at the University*"; a programme to support teachers and companies in mentoring students; and support for the UPF policy of embedding multiculturalism and multilingualism and supporting the strategies and approaches needed for teaching and research in a trilingual setting.

See: www.upf.edu/en/web/clik

4: Invitation: case studies of approaches undertaken in participants' institutions

Institutional information (please	
University **Academic discipline (if relevant)** **Course title (if relevant)**	_____ _____ _____
The below example is best described as (tick all that apply):	
A curricular approach Institutional/departmental strategy or initiative Supportive policy Other	☐ ☐ ☐ ☐
Description of curricular approaches, strategies or policies to embed research-based teaching and learning (max 250 words)	
What challenges did you encounter while implementing this approach and how did you overcome those, if there were any (max 300 words):	

5: Further resources

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