

Vertically Integrated Projects (VIP) @ the University of Strathclyde: How to enhance the student and staff learning experience through VIP

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ABSTRACT: The purpose of this paper is to outline and share with the wider academic community the experience of developing and implementing Vertically Integrated Projects at the University of Strathclyde during their pilot phase. In turn we consider the results of a preliminary evaluation, paying particular attention to the effects on the student learning experience, (and to a lesser extent the academic staff), and illustrate how those results and our own observations have been used to identify constraints in VIP development and expansion, in addition to those critical factors which have contributed to their success. We conclude with a reflective statement on `moving forward`, in the hope that others will be inspired to follow suit.

1 Introduction

Universities exist in a world of `supercomplexity`, (Barnett, 2000), challenged by increasingly demanding government imperatives, more international competition, rapid advances in technology and the growing importance of the knowledge economy. This in turn impacts on the traditional role of universities as providers of knowledge, and on students as the passive recipients of specialist knowledge, requiring new pedagogical approaches and educational practices (Tynjala, et al 2003).

The paper will present a model of curriculum innovation which seeks to foster inquiry-related skills for students through collaborating on shared research topics with staff in interdisciplinary groups. It offers reflections on the pilot phase of development from 2011-13 and presentation and discussion of emerging issues from preliminary evaluation and a discussion of the next steps in light of lessons learned from the pilot phase.

The discussion is primarily aimed to illustrate to readers how such a development might translate into their own contexts and to flag key issues that might warrant attention should others wish to adopt or adapt this model of delivery. Aspects of educational theory are drawn upon throughout to demonstrate the pedagogical underpinnings of Vertically Integrated Projects (VIPs).

1.1 Institutional Context

The University of Strathclyde, as part of its Strategic Plan and Education Strategy¹ to `develop a distinctive Strathclyde curriculum` and to `ensure a high-quality distinctive Student Experience` has gone some way in acknowledging the requirement for `new pedagogical approaches and educational practices` by embarking on an ambitious programme of innovations which include, the introduction and development of Vertically Integrated Projects (VIPs). These are new credit bearing interdisciplinary projects which enable undergraduates to engage in inquiry based learning alongside students of other disciplines and years, in addition to postgraduate researchers and academic staff, to generate new knowledge.

¹ The Education Strategy states: *By 2015, all courses at Strathclyde [will be] research-integrated and encourage interdisciplinarity, address global/real world issues, use problem-based learning and other project approaches, provide opportunities for partnership working with private, public and voluntary sector organisations, and for international experiences, and will look to stimulate the development of the graduate attributes: enterprising, enquiring, ethical and engaged.*

These draw on international best practice, particularly from the Georgia Institute of Technology (GIT)².

1.2 Concept

These projects give students from first year through to postgraduate level the opportunity to work with staff in inter-disciplinary teams on cutting-edge research and development projects. The projects aim to give the students the opportunity:

- To learn and practice many different professional skills.
- Make substantial technical contributions to a project.
- Experience many different roles on a large design team.
- Interact and receive support from more senior students and, in some instances, receive mentoring from PhD students involved in the project.
- Contribute to the completion of large-scale design projects that are of significant benefit to the research programmes of staff member.

2 VIP Development 2011-2013

2.1 Context

The first phase of development began in the AY 2011/2012, as a strategic initiative promoted by a senior academic, the Associate Deputy Principal (ADP) Education, enabled by funding from the Education Excellence Fund³ and led by a VIP Academic Champion.

Further support and guidance was given by Professor Ed Coyle from Georgia Tech, with four pilot projects covering a wide range of academic disciplines, academic staff and students from those different disciplines at different levels of study. These are highlighted in Table 1 below.

Table 1: VIP Titles, Start Dates and Description

VIP Team (date established)	Research Topic	Contributing Disciplines	VIP Team (date established)	Research Topic	Contributing Disciplines
Systems Biology of Polarised Growth (2011)	Systems Biology to improve yield of antibiotics	Engineering, Biology and Mathematics	Microfluidic Nano medicine for Cancer Research (2012)	Developing novel methodologies for cancer treatment	Chemistry, Engineering
Sustainable Energy for Development (2011)	Developing non-grid energy solutions to rural Gambia	Engineering, Business and DMEM ⁴	Toilet Challenge (2012)	Sanitisation solutions in Malawi	Civil Engineering, Law, DMEM, Management Science
Text Lab (2011)	Digital analysis of Shakespeare texts	English and Computer Science	Construction and Therapy (2012)	Collaborative construction in Rwanda	Architecture, Psychology
Building Strathclyde's Enterprise Community (2011)	Integrated support service for entrepreneurial students and alumni	Business Open to all disciplines	Developing competitive SMEs (2012)	Deploying diagnostic tools to improve performance of SMEs	DMEM

Defining our terms

Acknowledging there are competing definitions of what interdisciplinarity (as opposed to cross- or multi- disciplinarity) means, and little consistency in how it is applied in the

² The initial stimulation for the introduction of VIP emanated from attending a seminar delivered by Professor Ed Coyle during a staff study visit to the Engineering Faculty at GIT and observing the VIP there.

³ The Education Excellence Fund is a means by which staff can be supported in exploring innovations in learning and teaching aimed at undergraduates and/or taught postgraduates.

⁴ Design, Manufacture and Engineering Management

literature, it useful to outline the definitions applied by the authors in this paper. Davies et al (2010) note that the key features of inter-disciplinary activity is the extent to which disciplines integrate to produce something novel. They describe five sub categories of interdisciplinarity- relational, exchange, pluridisciplinarity, modification and transdisciplinarity. Using this continuum, VIPs are mostly examples of pluridisciplinary collaboration; “[requiring] two or more disciplines to combine their expertise to jointly address an area of common concern. It often occurs when the problem is too complex to be addressed by a single discipline. It requires integration and an explicit degree of exchange/learning from other disciplines. There is often a transfer of techniques and methodologies between disciplines. Research remains discipline-focussed though.”

However, for ease of reference throughout the paper, VIPs are described as interdisciplinary for consistency.

2.2 Development Domains

There have been four main dimensions to development of VIP teams in the pilot phase. These can be summarised as: teaching, learning and assessment; facilitating communication; establishing appropriate business processes and quality assurance and regulation. These are addressed in detail below.

2.2.1 Teaching, Learning and Assessment

A key feature of the VIP approach is to provide a context where undergraduate students work in an interdisciplinary group where they can undertake the four practices described by Huber and Hutchings (2005: 20) of “framing questions, gathering and exploring evidence, trying out and refining new insights in the classroom [or laboratory] and going public on what is learned”. Unlike many other approaches to inquiry-based learning classes, VIPs are long-term, rolling forward each year and have an explicit goal to contribute to staff research and/or knowledge exchange activity. This means not just constructing meaning and understanding of existing knowledge but also working with staff on joint discovery of new knowledge and its practical application.

The design and intended approach of VIPs position students in numerous roles throughout their involvement, spanning what Healey (2009) describes in his model as “students as “audience” and students as “participants”. Engaging with research content and research processes and problems as the projects progress, knowledge requirements are identified and new knowledge is generated as a result of the research output. It has been the intention to design the VIP teams to operate as interdisciplinary learning communities, operating in inquiry-mode.

Learning Outcomes, Assessment and Pedagogies

Prior to the establishment of the VIP teams in 2011, generic module descriptors were developed to capture Learning Outcomes (LOs) which were expected to be common for all VIPs. These learning outcomes were written to give flexibility and scope to enable co-creation of the learning in each team. Team-specific tasks are articulated at local level. The generic LOs include:

1. Complete a series of tasks which interface into a larger project.
2. Plan workload in order to deliver tasks on time and within budget.
3. Interact with the other members of the group to understand their requirements.
4. Complete other tasks specific to their discipline consistent with level.

Students are assessed in a variety of ways. These include reports, presentations; formative quizzes; production of posters (or other relevant media such as blogs & wikis) e.g. textlab2013.wordpress.com and logbooks. All VIP teams are encouraged (but not required) to include reflective statements to capture students' development as a result of participating in the VIP team. Other presentation of students work can be found at www.strath.ac.uk/viprojects

"In the drive to help students develop integrative habits of mind, it is important to remember that the effectiveness of curricular innovations depends on the pedagogies that support them", (Huber, et al 2007).

In typical approaches to project-based learning the teacher plays the role of 'expert' instructor, providing guidance and suggestions on achieving the desired outcome and is usually in response to 'learner need and within the context of the project' (Savery, 2006). Therefore if the outcome is already defined, there is less or little need for the learner to do that.

In inquiry-based learning (or constructivism) the learner as cited previously is not a 'blank slate', but brings past experiences and cultural factors to a new situation. The student is at the centre of actively engaging in their own learning. The tutor's role in inquiry-based learning is both of a facilitator of learning and a provider of information. Whereas, in problem-based learning the tutor does not typically provide information, but supports the 'process' of learning and 'expects the learner to make their thinking clear', (Savery, 2006).

One might argue that in developing VIPs and observing the variations in teaching approaches amongst them that new pluralistic pedagogies are emerging; ones which draw on the most effective features of the above but are dependent on the project and are co-constructed by the participants. Each individual can play a different role at different times, both as a producer of knowledge and as a consumer of it. This is in part due to the nature of the research problem and the diversity of the disciplines involved in individual projects. This is very much an embryonic observation at the moment, but one which we believe is worthy of further consideration and evaluation as we move forward to roll out of VIPs at Strathclyde in AY 2013/14.

2.2.2 Communications

Initial communications in VIP centred on promoting the VIP in order to recruit students and for staff to become involved. This took the form of cross campus posters, events, lecture presentations and engagement with key university committees. Professor Ed Coyle visited in phase 1 to formally launch VIP at Strathclyde and to showcase VIP experiences from the GIT.

In the first year of the pilot there was little use of the institution's VLE (Virtual Learning Environment) Myplace, to promote the VIP or connect the projects together. Interestingly, many projects (organised and instigated by the students) had setup their own social networking sites and websites using a variety of social media tools, such as Twitter and Facebook, to communicate within their teams and manage their information and knowledge exchange.

2.2.3 Establishing Appropriate Business Processes

Due to the nature of the VIP initiative, many of the standard, Faculty-facing business processes have been insufficient. They do not lend themselves easily to interdisciplinary activities which transverse Faculty structures.

The pilot projects, have been supported since their inception by members of the university's Education Enhancement Team, mainly in VIP administration, evaluation and promotion. Similarly the lead academic champion has been involved in every stage of development from concept to implementation to review. This group of individuals have been central to identifying relevant solutions to business processes, such as selection, recruitment and management of student information in terms of class registration.

2.2.4 Quality Assurance and Regulation

Related to the aforementioned discussion about business processes, perhaps the biggest challenge of the pilot phase has been `finding a way through the curriculum` to offer such opportunities to students. The main challenge here has been to find `space` in the regulatory framework to run VIPs and to find agile ways of ratifying the creation of new VIP teams whilst assuring confidence in quality assurance across Faculty boundaries, systems and processes. Given the focus on developing and running the pilot "in-year" three, options of how students could gain credit for participation were agreed and are currently under review. Any student participating in VIP should earn credits. Methods of participating at present include students participating as an elective; participating as part of an existing class (usually where there is scope to self-define a project) or as a class which is in addition to the 120 credit requirement for the academic year.

3. Pilot Evaluation

3.1 Methodology

We are very much at the start of an on-going evaluation process in that the VIP Pilots started in the AY 2011/2012. Therefore, these should be viewed as emergent findings, which mainly focus on, but are not wholly restricted to, the student experience. Our observations are informed from a range of sources:

- Student surveys (2) - (completed end of the AYs 2011/12 and 2012/13)
- Informal student focus groups
- Staff workshops/meetings
- Student/Staff workshop at VIP Showcase Event⁵

Additional `lines of evidence` come from our observations and experiences of developing and implementing the VIP across the university

3.2 VIP Student Experience Survey Results

An interim evaluation of the VIP Pilot took place at the end on the AY 2011/12 with the 61 students, who took part in one of the four pilots VIP across the university. This was conducted through a small scale survey and informal focus groups. This comprised of a questionnaire, with a mix of closed, open and scaled questions, which aimed to capture their experience of participating in the projects. This was run again in the following AY 2012/2013 to capture the experiences of the additional 60 students participating in the four new VIP Pilots.

⁵ A `Showcase` event was held in March 2103, to showcase the student outputs, to foster further communication/collaboration with the GIT (through a live link-up) and to give non-VIP participants an opportunity to discuss the benefits and constraints of being involved in a VIP, with VIP teams.

Table 2: VIP Evaluation Response Rates

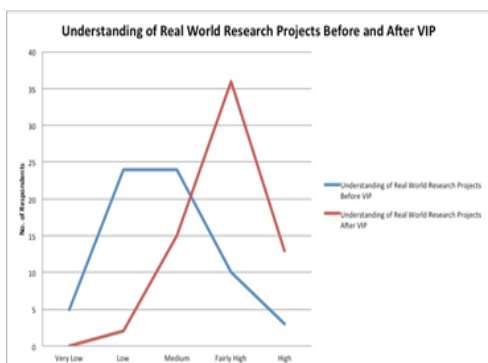
Academic Year	Number of Students	Number/% of Student Responses	Total/%	% Year Group Responses*				
				1 st	2 nd	3 rd	4 th	5 th /PG
2011/2012	61	40/66		6	39	27	3	24
2012/2013	60	33/55	73/61	0	45	39	6	9 n=73

*Percentages may not sum due to rounding

Much of the evaluation was framed around the `learning`/increased knowledge` of `own` discipline and `other` disciplines. Other questions related to attribute and skills acquisition. Final questions focused on levels of support from both staff and students.

A summary of (merged) responses indicated that:

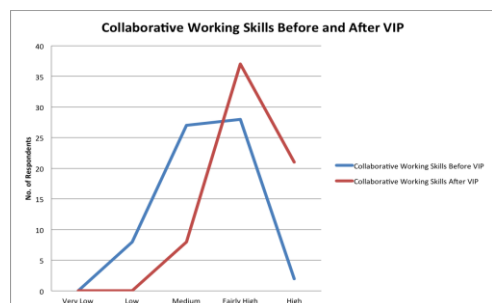
- The vast majority of students found participating in a VIP to be rewarding in increasing knowledge of their own subject and that they found their participation to be an enjoyable experience.
- A significant majority also reported that they had increased their knowledge of a subject other than their own.
- Students reported an increase in personal competences in the areas of confidence, understanding of real world research projects, collaborative working, leadership skills, team building skills and communication skills following their participation in the VIP as compared to their levels prior to participation. A section of indicative responses (merged data from both years) are highlighted in Graphs 1.1-4.
- Students also reported an increase in other skills, e.g. in project management, networking and presentation skills. Some highlighted the positive effects of “working and helping students with less experience”.
- Interestingly, when asked “Please rate the extent to which you felt supported and encouraged by fellow students and staff while participating in the VIP”, the results from both surveys are almost identical in relation to the support received from VIP staff, and students from the same subject, as the vast majority rated it `very good` or `good`. Very positive results were also recorded for `support` from students in a higher year of study and whilst not as high, support from students studying a different subject, still rated very positively.



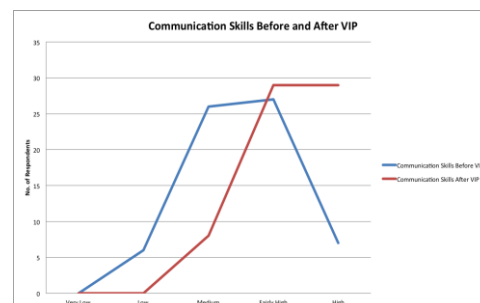
Graph 1.1 – Understanding of Real World Research Projects Before and After VIP



Graph 1.2 – Team Building Skills Before and After VIP



Graph 1.3 – Collaborative Working Skills Before and After VIP



Graph 1.4 – Communication Skills Before and After VIP

3.2.1 Benefits of VIP Participation

Students were asked, as part of a free text response, to state what they felt were the three most positive aspects of participating in a VIP. The three aspects which were cited most frequently and strongly were:

1. The nature of team working, interaction and collaboration between students from different years and different departments.
2. The fact that they were working on `real world` research/problems.
3. The interdisciplinary nature of the collaboration and research.

Other positive responses related to its (VIP) potential as a teaching method, improving ones CV and the impact on knowledge and understanding of ones (the student`s) own discipline. The only observable `difference` between the year one and two survey results is that there was more of an emphasis, in the free text responses to `self-awareness, self-management and time management` in the latter survey.

There is significant emphasis in the results on the perceived benefits from team working, collaboration and interaction between students (and staff)⁶. This is important as collaborative (group) learning can also improve students' self-efficacy and metacognition by virtue of weighing up other peoples' views, and arriving at and communicating their own position based on the interaction with group members. Additionally, more co-operative learning environments have added benefits in facilitating 'living knowledge', relationships and trust and generating social capital.

The outcome of the evaluations and from informal discussion with staff and students is overwhelmingly positive. Some administrative and infrastructure issues were identified, e.g. in relation to timetabling and physical spaces to meet. These are addressed in 3.2.2.

3.2.2 Scope for Improvement

There were no issues identified through the open/closed, scaled questions in the survey. However, students were asked to identify, in a free text response, any areas that could have been improved. The main ones cited were:

- Timetabling – this had a dual aspect, namely some course timetables/structures could not accommodate the VIP and students therefore had to do them as additional credits. Secondly, since students came from different departments/faculties it was difficult for some to get a time when they were all free to meet; in addition some VIP teams had difficulty in finding a place to meet.
- More advertising and promotion to increase awareness of the VIP and providing more opportunities to bring the VIP teams together.
- The main potential improvements mentioned in the second survey related to organisation, communication and start dates; some students felt that better planning and more structure around the projects would have been beneficial, communications to the teams and between the teams could have been improved and that start dates could be brought forward to earlier in the semester as it took a while to `get settled into the project`. Some also mentioned that recruiting from a wider pool of students `is key to ensure a skill match`.

⁶ Team working and communication skills have been highlighted as the most sought after graduate skills in a study of employers' needs by the Council for Industry and Higher Education (Archer & Davison 2008).

3.3 Student/Staff Workshop Feedback

The main aim of the `workshop` element of the Showcase event was to encourage staff and students involved in VIP to share their experiences and in addition provide an opportunity for those not involved in one to ask questions/raise issues about starting a VIP.

There were 65 attendees at the event comprising a mix of undergraduate, postgraduate researchers and academic staff. The feedback received from the seven discussion groups are as indicated below.

Table 3: VIP Development `Variables`

Areas for Discussion	VIP Teams - Academic Staff and Students	Non-VIP Participants – Academic Staff and Students
Motivational Factors	<ul style="list-style-type: none"> To engage in `real world` activity, which reflected research motivations. To be involved in an interdisciplinary project, motivated by an interesting topic, `outside of discipline-led` research. To `do something different`, and gave an `opportunity to meet new people in other years`. 	<ul style="list-style-type: none"> Multi-disciplinary work. Projects were `new and exciting` and added `a different dimension to learning` Opportunity to develop an actual project while learning. A particular motivation for staff was `getting involved with enthusiastic students to encourage them`.
Benefits/Facilitating Factors	<ul style="list-style-type: none"> Learning in a different way, which `increased understanding of how things work`, particularly an `interdisciplinary appreciation`. Learning about self- `self-awareness` and `learn what makes a difference`. Learning about and from others - `getting to know staff – building up relationships` and `gaining knowledge from other departments`. 	<ul style="list-style-type: none"> To gain more knowledge about the existing VIP and some `start-up` guidance. To `help people`, this seemed to be two-fold in that it related to a sense of `social awareness`, and also to students` own development. Recognition for effort and clarification of student credits.
Constraints	<ul style="list-style-type: none"> Timetabling came across as the main constraint. Time to meet, in particular was a problem, especially with a large group of people. Project management time, (less frequently cited). 	The main barriers or constraints upon starting or getting involved in a VIP were: <ul style="list-style-type: none"> Time. Lack of faculty awareness,(for the staff), Lack of research background and `outreach`.

This is simply the start of a data collection process, which will be continued with a more comprehensive evaluation in AY 2013/2014. Furthermore this will be complemented by evaluation undertaken by our VIP international partner GIT, which will focus on social network analysis. However, even at this early stage, we are encouraged by the results and feel confident that the direction of travel is appropriate and believe that we can provide a useful foundation for others who are interested in pursuing similar initiatives.

Addressing the Challenges

in Curriculum Design

- The timetabling issue remains difficult to resolve in that the nature of the innovation itself is the issue in the sense that including many different disciplines, inevitably results in `timetable clashes`. Similarly, some point to professional bodies and resulting requirements as a constraint on curriculum flexibility. We would hope to `mine` this more thoroughly in the following AY. The `meeting place` or lack of, has been marginally easier to resolve, with the help of the ADP, in securing dedicated space for the VIP teams to meet and work. The VIP teams now have such learning spaces ring-fenced and block booked on the central timetable for 12 hours each week day.
- The `credit` issue has been somewhat ameliorated by the introduction of generic class codes, which confers 10 credits to any student registering for a VIP, regardless of discipline or department. (Students also receive a certificate which shows which VIP they have participated in). However, this has not been without its problems, in that the current student records system has a number of constraints. Therefore, a separate database of student details has been set-up and we are exploring a process that will be more sustainable in the

longer term. There still remains an issue of whether students take part as an elective or for extra credits above their core credits for the year.

in Communications – to and between...

- Myplace provides a centralised VIP resource and communication hub to connect all the VIP projects together to foster an online community where participants could find out more information about other VIP projects, communicate both within and outwith their own VIP project and post any project problems in discussion forums. The online community area is also an ideal place for both VIP administrators and VIP project leads to gain a helicopter view of the different VIP projects on offer and additionally allow them to gain an insight into the nature of the discussions of their own VIP Team and enable `intervention` if problems were identified. Learning from student practice in phase 1 it seemed logical to introduce a centralised VIP resource hub to allow document exchange, online discussion and collaboration across the VIP projects. Online collaboration tools include document storage, discussion forums, email distribution lists, video and audio streaming and dedicated online room booking tools. The online community area also allows for the integration of social media tools that were popular and well utilised from observation of practice in the first year of VIP.
- Participants were given full control of the VIP community to foster a sense of ownership for their respective project areas and are actively encouraged to participate in the discussion forums for other VIP projects.

in Enabling Learning Communities

- Learning tools/resources – a series of VIP seminars were planned and implemented throughout AY 2012/2013, which focussed on engaging external speakers to lead on: Entrepreneurship, Project Management and Leadership.
- Those involved in setting up the support infrastructure in VIP have invested time in facilitating workshops which bring all VIP staff together. These have been important fora to air successes, challenges and ideas for future improvement. This format of facilitated support is becoming more of a challenge as the initiative grows.

in Process and Procedures

- A VIP Board has been established to have academic oversight of existing VIP and to implement an approval process for new ones. This should go some way towards ensuring that university quality assurance procedures are being adhered to, in addition to streamlining business processes. The Board will also have access to seed-funding to `kick-start` a VIP.

5 Conclusions

Lessons Learned

In summary, this paper has presented an example of curriculum innovation which delivers interdisciplinary research and enquiry opportunities for multi-level groups of students. The VIPs have doubled in number in the pilot phases and involvement in a Vertically Integrated Project has undoubtedly brought benefits to those respective students and has enhanced their overall learning experience. There are also initial signs that there are advantages to the staff of either being part of, or leading a VIP, no least of which is through a variety of `research benefits`, in addition to having more motivated and enthusiastic students. Whilst we recognise that we are in the preliminary stages of triangulating evaluation data to better understand the experiences of, and effects upon, a range of stakeholders we feel confident that we are in a position to suggest a number of critical factors that have contributed to the success of the VIP initiative:

- Senior Executive support – the VIPs are a key strategic initiative for the university and are therefore `championed` at Executive level
- Commitment and time invested by both academic staff and students – both VIP staff and students have given a considerable amount of their own time to the projects.
- Centralised support for business processes and educational development - the VIPs have been resource intensive in the pilot stage, with dedicated professional services staff responsible for development and implementation, which serves to demonstrate the university's commitment to the initiative.
- Collaboration with, and support from, the GIT partnership.

Moving Forward

The VIP have doubled in number in this initial pilot phase and there are many indications that there are a number about to come `on stream` given the interest and enthusiasm shown in them across the university. It is also likely that Strathclyde's new Technology and Innovation Centre (TIC) will provide a vehicle for expansion of the VIP Programme once in operation.

This interest is not confined to the institution as other universities have expressed a desire to find out more about them with a view to `rolling-out` within their institutions. In addition, many employers and other external bodies have been impressed by both the initiative and the VIP students themselves e.g. representatives from the Times Higher Education periodical met with some of the VIP students on a recent visit and suggested they were to be `commended` on their achievements. Similarly the media has also recognised the Construction and Therapy VIP by doing a feature on it. <http://bit.ly/YBnE1k>

A Strategic Review of the VIP is planned and this will focus on questions of institutional capacity and resource implications about staff development in relation to academic practice and support requirements. The main one however, will be the issue of scalability, whilst acknowledging the `success` of the VIP, one does recognise that at the moment they are open to a relatively small number of students and in order to expand significantly, changes to academic design, curriculum alignment and institutional processes and procedures would have to take place.

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