VERTICAL INTEGRATED PROJECTS FOR WORK-INTEGRATED LEARNING: LEARNING ABOUT RESEARCH AS WORK

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Abstract

Vertically Integrated Projects for Work-Integrated Learning (VIP4WIL) is an on-going project at University West in Sweden that aims to innovate educational methodologies to engage students in research from their undergraduate studies. This project seeks to cultivate interest in postgraduate education and research careers by integrating peer-to-peer and work-integrated learning (WIL) approaches within real-world research environments. The project addresses significant challenges in Swedish higher education, including the recruitment and retention of diverse researchers and the urgent need for qualified graduates in sustainable industries. By aligning VIP with WIL, this study will explore how students can learn about research as work, fostering a richer learning experience that prepares them for future careers. This paper is work-in-progress and details the conceptual framework of VIP and WIL, the institutional setup of the VIP4WIL model, and early experiences in its implementation. This research aims to enhance the educational landscape by producing graduates who reflect the diversity of the Swedish population and are committed to sustainability. Key findings emphasize the importance of multidisciplinary collaboration and the development of research competencies among students. Ultimately, VIP4WIL aspires to create a replicable educational model that promotes structural changes in higher education, ensuring that students gain practical skills and knowledge relevant to contemporary sustainability challenges. Long-term research will assess the model's effectiveness in inspiring students towards research careers and its broader impact on the sustainability sector.

Keywords: Vertical integrated projects, work-integrated learning, higher education, research-active education, educational model, broadened recruitment, sustainable industry.

1 INTRODUCTION

The world, and the world of work, must rapidly transform to meet the present global sustainability goals and so needs the higher education institutions in order to systmatically innovate educational models to produce more, high-quality research graduates committed to working in the sustainability sector.

The motivation for this study is grounded in the contextual framework of current Swedish higher education. Firstly, the competition for the best researchers is hard and Sweden has a significant challenge in recruiting and retaining researchers with a diversified background. This applies to the research environments of many universities as well as to industry. The Swedish Higher Education Authority (UKÄ) has described the challenge in postgraduate education[1] where many, mainly foreign, doctoral students leave Sweden three years after graduation. Secondly, if Sweden is to be a competitive and innovative country, it needs to be attractive to be a researcher. In particular, there is a significant lack of qualified graduates required by the sustainable industries and the green transition.

At University West in Sweden a research project called VIP4WIL (Vertically Integrated Projects for Work-Integrated Learning) is conducted. The VIP4WIL project will develop a new educational model with the aim of getting more students interested in postgraduate education and a future career as a researcher. This takes place through pedagogical innovation of how students can participate in research projects and research environments already in their undergraduate education through peer-to-peer and work-integrated learning (WIL) approaches. This offers students a richer, more experiential and self-motivated approach. At the same time, researchers have the opportunity to utilize this valuable undergraduate research resource to enhance their current research endeavors and potentially uncover new avenues.

The aim of this paper is to present and discusses how to align VIP with WIL as an approach for a research-active education where work-integrated learning is contextualized as integrating *research work*

[1] *Många utländska doktorander lämnar Sverige efter examen*. UKÄ 2019. https://gamla.uka.se/download/18.43eb99a17cdfa5c0635703/1637144785033/rapport-2021-11-18-vanligast-att-utlandska-doktorander-arbetar-inom-hogskolan.pdf (In Swedish)

in a learning environment. The paper starts with an overview of concepts related to VIP and WIL as well as the VIP4WIL's two guiding perspecitives (sustainable industry and broadened recruitment). The case of University West's VIP initiative is presented with the focus on the development and institutional setup of the VIP4WIL model. Thereafter follows a description of the model's key components as well as early experiences of how VIP4WIL has been introduced at the institutional level. From the results we provide reflections on and implications for i) WIL contextualized as research work in and for a sustainable industry and, ii) the broadened recruitment perspective as retaining candidates with a diversified background.

2 KEY CONCEPTS

The VIP4WIL project model takes inspiration from from four key concepts: verticle integrated projects (VIP), work-integrated learning (WIL), sustainable industry and, broadened recruitment.

2.1 Vertical integrated projects

Vertical integrated projektct (VIP) draws on university initiatives in both the US and United Kingdom, where the concept of VIP was first developed in the engineering courses, but then spread to more areas [1]. VIP is a novel approach for a research-active education where students are engaged in team based research practice led by faculty staff. The research teams consist of undergraduate students ranging from all year groups and faculty staff ranging from different disciplines leading research projects [2]. VIP was originally designed to enable undergraduate students to earn academic credits while working on real-world research challenges, in conjunction with research staff and academics. It involve students from multiple disciplines working together on a long-term, team-based research project that is guided by faculty mentors and industry partners [3, 4]. VIP has gained popularity in recent years as a method for promoting work-integrated learning (WIL) in higher education, and where work in this sense is regarded as "research work".

2.2 Work-integrated learning

Work-integrated learning (WIL) is based on the assumption that learning within and for a changing working life is needed. WIL approaches are traditionally found in the context of higher education as a means of improving higher education through better integration of learning with the world of work [5]. Engaging students in well-founded educational activities provided in both educational and work-related environments creates valuable WIL experiences, which can strengthen specific learning outcomes, e.g. by developing professional skills as a preparation for working life or to develop generic abilities that might otherwise not have been possible in a traditional classroom [6]. Björck and Willermark [7] argue that WIL is a multidimensional learning phenomenon and that the discourse around WIL maintains a research terminology that fails to capture what this 'multidimensional' really comprises of. According to Billet [8] WIL refers to the learning that students are intended to participate in and acquire through work-integrated education (WIE). The WIE approach is then the starting point for how the education is organized and how the teaching is didactically designed, built up and carried out. The pedagogical starting points are also often connected to some form of ontological approach and human view. Hence, WIE can create the conditions for WIL. This means that WIL can be an outcome, as well as the basis on which the pedagogy stands and refers to the learning that, by gaining access to different environments and processes, integrates experiences from different contexts. Such experiences may be gained from contexts and cases that go beyond the direct control of the higher education institution [9].

Hence, WIL includes specific epistemological and pedagogical approaches, whole courses and programs designed to integrate work and university learning, as well as a multidimenstional phenomenon [7] and a research field where different types of connections between work and learning are explored [5].

In the VIP4WIL project the ambition is to provide students with conditions for learning about research as work. This is contextualized and expressed through student learning by doing research alongside formal instruction, and by working on real-world tasks linked to research projects that involves collaboration with societal organisations. In this contextualization we focus the student learning on how to work as a researcher by practicing research. This kind of learning is not possible just through hearing and reading about research in, for example, a method course or by reading research articles or books.

2.3 Sustainable industry

The importance of adopting a work-integrated perception of research as a job has emerged as a key to the future sustainability of the Swedish workforce. Swedish industry has potential to lead the transition to a more sustainable industry, both within and outside the country's borders. Individual companies, but above all large parts of value chains, can bring about the change that is necessary through a collective approach. Academia can thus play a unique role in the fulfillment of SDGs [10]. Sustainability goals can also be understood as a kind of challenge that encompasses many aspects and can be defined as a "wicked problem," that is, multi-causal, involving multiple stakeholders, connected to other kinds of problems and in which every solution has ramifications across various disciplinary and contextual levels. In this way we look to link VIP to WIL, to the sustainability commitments of the university as well. The research projects selected as the basis for this study are all connected to the sustainable industry sector, see further in section 4.4. The sustainability approach is not just limited to the substantive focus of the research projects, but in the design of VIP4WIL in that we aim for equitable gender inclusion (SDG 4.3) and explicitly teaching sustainable development (SDG. 4.7).

2.4 Broadened recruitment and broadened participation

The European Higher Education Area and the Bologna Process has, for more than 20 years, worked to improve the quality of higher education and, by extension, research in Europe. At the outset, the reforms focused on broadened access and participation in higher education, as well as supporting lifelong learning and employability.

By broadened recruitment, UW refers to the work to increase the share of students in categories that can be considered underrepresented today student group. By broadened participation, UW means the work that makes it possible to conduct education on equal terms for all students and which enables each student to reach their full potential during their studies. Student-centred learning, inclusive approaches, and accessible learning environment are important conditions for the work. In the work with broadened recruitment, UW focuses on the following categories: Social background, Swedish/foreign background and gender

3 APPROACH AND CASE CONTEXT

The overall approach for the VIP4WIL project is to study the ongoing processes, conditions and outcomes of the project as a research case. In this rather pragmatic approach emphasis is put on useful, practice-based knowledge that is particularly relevant in shaping the scope of the research issues in the project. Methodologically, this design is better used for dealing with complex, dynamic problems, e.g. innovation and institutionalisation processes actualized in the VIP4WIL case. It is needed to be flexible and adaptive throughout the process as iterative inquiry, experience, knowing and acting inform ways to improve the research projects' usefulness and value.

In our case the research group is transdisciplinary, involving researchers and academic staff from different disciplines (social sciences, engineering sciences) such as political science, information systems, community building, global governance, economics and business economics, electrical engineering as well as industry representatives from organisations taking part in the VIP4WIL research projects. Due to the project's transdisciplinary nature activities take place through collective and collaborative interactions across disciplines and with actors external to the higher education institution.

Though it is an intertwined process, we try to distinguish the idealised transdisciplinary research process, which helps structure a project, from the actual transdisciplinary research journeys that one goes through when trying to develop, implement and institutionalize the VIP4WIL model. The research process is designed to cater to the kinds of results that are needed in both societal and scientific practice. Systematic and continuous project-, and self-learning sessions with reflective analyses and milestones will address the various challenges faced and decisions made during the project journey.

Data collection on the VIP4WIL institutionalization process as well as on the student learning processes and outcomes will start once the model is implemented in spring 2025.

3.1 The Case of University West

UW has 13,000 enrolled students, where of 5,100 full-time. Altogehter UW has 720 employees (including researchers, teaching staff and administrative staff), distributed over four departments/faculties and one support operations department. In a broadened recruitment perspective, UW has the highest level in

Sweden of students with a non-academic background. Students from UW are establised in the labour market and thus achieve high level of employment after graduation, which means that UW is at top level in Sweden with 87 percent of the graduated students established in the labor market one year after exam. In research the level of external funding of research is high, over 50 percent of the total amount. Engaged collaboration with industrial and societal actors is predominately in almost every research project. UW offers phd eduation in Work-Integrated Learning (50 doctoral students) and Production Technology (30 doctoral students).

The overarching profile of the unviersity is work-integrated learning and the university is mandated by the Swedish government as the only higher education institution to develop WIL and offer degrees in WIL. The key principle here is that students learn through both traditional teaching on campus, but also through applying theoretical knowledge to real-world practices. In the case of VIP4WIL, this knowledge will be around learning the work of research, integrateing theory and practice and applying knowledge in specific research projects aimed at enhancing sustainability.

4 THE VIP4WIL MODEL

4.1 VIP4WIL aim and goals

According to the contextual framework of current Swedish higher education, the VIP4WIL project intentionally addresses two important perspectives: i) how universities and industry can introduce and engage students with a broadened recruitment perspective; ii) how students can learn from research work with a sustainability perspective. The overall goal is to attract more, better prepared researchers, who more accurately reflect the Swedish population both in terms of gender and academic background, and who continue to work with research and sustainability in both within academia and industry.

To achieve the overall, long-term goal, this project aims to develop a new model, the VIP4WIL model, for research-active and research education in the higher education sector that gives industry and academia the competitive conditions for a sustainable and strong sector.

The short-term goal of the project is to trial VIP4WIL over a three-year period. The key deliverable for this short-term goal will be a handbook that outlines the model as developed and tested in the initial project phase of the project as proof of concept. The ambition is to have it institutionalized as an overall pedagogical model, where students earn academic credits through course modules that integrate research, collaboration, and education in the university's operations.

4.2 Key components of the VIP4WIL

The project is in its initial phase of developing the infrastructure, environment and courses. The overall project set up and the key components of VIP4WIL is illustrated in Figure 1.

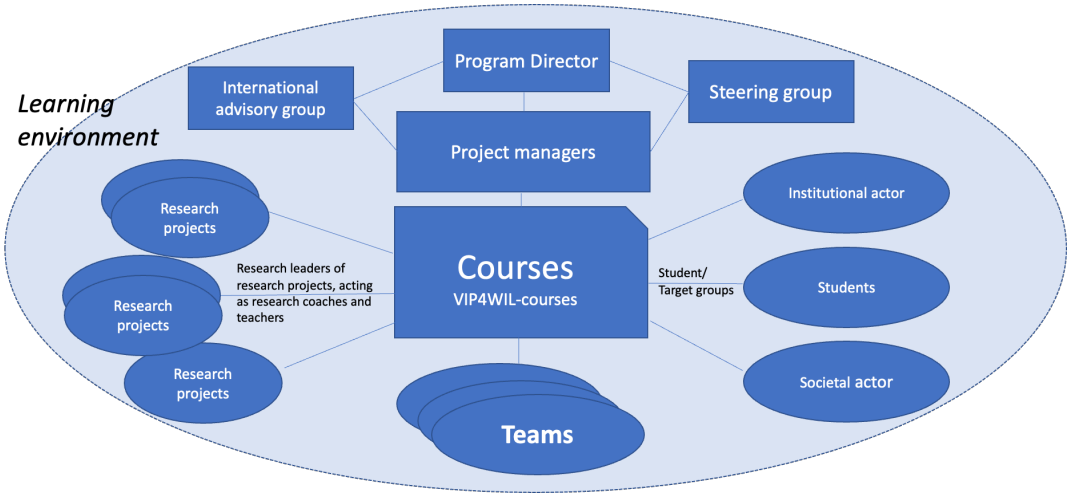

Figure 1. Project set up: a research-active education in an integrated research and education learning environment

4.3 Courses

At the core of the model are course modules. These are designed as four separate course that is linked in its progression. One introductory course is on research orientation. This course includes the work practices of research such as methods, study design, data collection, project management, article writing, short reports popular science, cutting edge practice, and new scientific discoveries, etc. Learning goals cover both disciplinary and professional skills. Key to the WIP4WIL research orientation course is seminars led by active researchers who introduce students to their research and methodology. Theory and practice of WIL and its relationship to vertically integrated research and learning is covered.

The follwing course modules are more pracice-based. The course integrates VIP and WIL by emphasising the skills and competencies students acquire through participating and practising the research. The focus of the course is peer-to-peer learning, learning by doing, and reflecting on one's own learning through portfolio methodology and logbooks. Students reflect on experiences such as mainstreaming gender equality and inclusion in project design, collaborative ownership and ethical considerations of the research process, as well as the assembling of diverse research teams. Skills such as mentoring, management and planning, as well as competence to work with problems that cut across diverse research traditions and subject areas as well as general competences and skills from a WIL perspective are emphasised.

4.4 Teams

In the pilot phase of VIP4WIL, five on-going **research projects** linked to various sustainability issues, will form the basis of student learning and action research:

- FREIIA is linked to “A socially sustainable industry” and “Global competitiveness”
- Traction battery production is linked to “Resource efficient and resilient value chains”, ”Climate neutral and circular production” and “Global competitiveness”.
- Sustainable Forest management is linked to “Resource efficient and resilient value chains,” “Climate neutral and circular production,” and “Global competitiveness”.
- City planning and attractiveness - Trollhättan municipality: is linked to “Strategies into digital innovations to create a sustainable and vibrant city centre”
- Total defense – Combitech and civil society: is linked to “Develop innovative responses to the challenges faced by Sweden's Total Defence”, “Sustainable crisis management and societal planning”

The students join a research team through the **appointed research projects**. To join VIP4WIL courses, **students** have to apply and be accepted to these research projects. All this occurs alongside the student’s existing study programme, i.e. it is an extra curricula approach.

The research **teams** are multidisciplinary, drawing **students** from across campus. They are also vertically integrated maintaining a mix of undergrad students through to PhD students each semester. Each undergraduate student may participate in a **research project** for up to three years. The research projects are long-term and include external partners. The continuity, technical depth, and disciplinary breadth of these teams enable the completion of projects of significant benefit to faculty members’ research agendas.

The **researcher** component of VIP4WIL is where new and innovative research is conducted on key sustainability and green transitions challenges. Team research leaders act as both professional researchers and educators. They sit on two chairs: on the one hand they practice their profession and work as researchers in the **coaching** process together with the students. On the other they practice their profession and work as **teacher** as they are supervising the students in their practice of research, their professional craft, in a kind of apprenticeship role. To achieve this, the research and the eaching will be orientated towards problems and approaches that are typically complex and multifaceted requiring new collaborations across traditional academic disciplinary divides. In addition, horizontal integration of teams opens the opportunity for **students** to interact with, and teach and learn from those working outside their own discipline at the same time as the verticle integration serves for peer-to-peer learning.

4.5 Societal actor

The third component, actor, important to VIP4WIL is wider industry who are brought more systematically into university research education. To achieve this, industry partners will collaborate around setting and supporting VIP4WIL in many ways. They can support research agendas, host student research internships, facilitate graduate recruitment, participate in elements of VIP4WIL governance and participate in the course modules as leaders, role models or brokers for competence and career development. These partners are linked to the research projects identified above and include local and national government, business, industry, and civil society organisations.

4.6 Institutional actor

Another component of VIP4WIL is the university itself, the organising body that is about to integrating the WIL4WIL model for a new research-active education. The goal of this component is to establish VIP4WIL alongside existing university structures and processes in a mutually beneficial manner. To achieve this the project will (i) align participation in VIP4WIL with programme requirements at both undergraduate and graduate levels, and across all involved disciplines; and (ii) integrate quality assurance and (iii) new governance structures and processes with existing university structures and policy frameworks. Once in place, undergraduate and postgraduate students will have the possibility to join VIP4WIL teams and earn academic credit for their participation in discovery and design efforts that assist faculty and graduate students with research work and sustainability issues in their areas of technical expertise.

4.7 Learning environment

The creation of an environment is key to the success of the VIP4WIL as students from different backgrounds (national and international) programmes, skills and competences will create a synergy that is key for the success of the VIP4WIL. The ambition is to create a physical and digitally supported environment and inclusive atmosphere where all the VIP4WIL students and teams can experience a vivid, interdisciplinary and well-integrated learning environment. Students will be able to try out different research skills and competences here: peer-to-peer learning, creating posters and engage in research-active education activities. It is envisaged that this environment will be a place to work and learn together outside of a traditional classroom or research lab.

4.8 Steering and advisory groups

An internal steering group has been established to provide general input to the overall project activities. This group will also give expert knowledge on student engagement, quality assurance issues, broadened recruitment, external collaboration partners, WIL modalities and WIL content issues as well as inform and motivate students and colleagues to engage in VIP4WIL. Furthermore, an external and international advisory group was appointed early on to provide advise on opportunites and challenges of VIP experienced from other sites globally. They give comments and input on epert knowledge on VIP, teams management, student task and engagement, learning management and will further share and promote global VIP and VIIP4WIL experiences in their international networks. Engaging in cooperation with international universities that are engaged in the VIP-consortium includes participation in international annual meetings.

5 REFLECTIONS AND FURTHER WORK

The expected outcome of the VIP4WIL project is a new educational research program structure that can be emulated across Sweden to create structural changes and a new type of structured course program in the Swedish higher education system.

So far we see that VIPs are a valuable tool for promoting WIL in higher education. Through VIP4WIL students are introduced to, practice and learn research in research teams that work on actual sustainable industry challenges with real-world international research and sustainable industry third party partners. By providing students with the opportunity to work on and train in research that is transdisciplinary, sustainable and team-based, VIP4WIL will support students develop a range of skills that are essential for success in the workforce. The transdisciplinary nature of the VIP4WIL approach will offer students the opportunity to develop softer, non-technical, but transversal skills such as communication, project management and team-working skills in an authentic real-world, problem-solving context.

The WIP4WIL initiative has from start emerged into a renewal of the pedagogical approach through a quality development process based on a lively exchange of experiences from academic staff of various undergraduate programs, research leaders and the support staff at the operation and support department. The course descriptions and objectives are developed by research leaders together with other departments and disciplines in mind.

The challenges for the project includes to have a good number of research projects (projects, groups, environments, labs etc) that address the sustainability perspective. The project will contribute to attract students from backgrounds foreign to research and academia. Hence, striving for recruting and having a good number of student graduates, who more accurately reflect the Swedish population both in gender and academic background, and who go on to work in the Swedish sustainability and green transitions sector is another challenge.

A research design and evaluation framework is under construction. The overall aim of the research is to examine effects and explore experiences of VIP4WIL in transdisciplinary research from the perspective of students, community actors, faculty and industry partners. The research question to be addressed is to explore how students can contribute to and learn about research in a real research environment, and whether it ultimately contributes to more students choosing a research career. The plan is to have VIP4WIL fully developed and institutionalised during 2025 in order to start collecting data for evaluation of its organisation, implementation and impact.

Further work is needed to research on the long-term impact of VIP4WIL and to identify best practices for implementing VIP4WIL in different educational contexts. The overall ambition is to make the VIP4WIL learning environment resemble the the world of work and the work of research. The goal of the reserach is to give the students expanded subject knowledge while improving their collaborative and process-oriented research skills, and hopefully sparking their interest in a continued research career. In-depth qualitative indicators as well as key impact measurements will be further developed.

The model will hopefully be the basis for potential policy change in national and international higher education environments.

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