EasyChair Preprint

№ 6705

Linking Pre-College STEM Students to Science, Technology, and Engineering Industries Through a Work-Integrated Learning (WIL) Curriculum

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September 27, 2021

Linking Pre-college STEM students to science, technology, and engineering industries through a Work-Integrated Learning (WIL) Curriculum

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Publication Status: Submitted for Publication as of September 2021
For publication updates and suggested citation format, please contact the author or you may visit the author's ResearchGate account.

ABSTRACT
Partnerships with stakeholders are necessary to fully achieve the K to 12 Program of the Philippines' Department of Education (DepEd) to develop the competencies, work ethics, and values relevant to pursuing further education and joining the world of work. This study utilized an action research study and descriptive survey research wherein work immersion students (n=32) were immersed in science and technology-based industries and performed tasks related to their prospective course in college. After the program, respondents evaluated the work-immersion implementation in the following areas - preparation, work immersion environment, relevance, delivery, and overall implementation. Results showed that respondents strongly agreed on the successful implementation of the work-immersion with average computed means of - 3.52, 3.54, 3.42, 3.56, and 3.54, respectively. Furthermore, respondents perceived that coaching from their supervisors, support and encouragement, an effective system of accountability, and monitoring were the factors that help in their successful work immersion.
Keywords: work-integrated learning, STEM Education, work immersion, school-industry partnerships, K to 12 Curriculum

INTRODUCTION
A survey reports that about 48.4 percent of the 2.4 million unemployed Filipinos were between 15 to 24 years old, with some high school education level (Philippine Statistics Authority, 2016). This youth unemployment record continues to hinder meaningful economic development in the Philippines (CFC, 2018). Among the reasons behind this unemployment rate are a job-skills mismatch and lack of knowledge and skills training or work experience. To improve employment prospects, curricular reforms in basic education was among the top agenda of policymakers.

In 2013, the Philippines' Department of Education (DepEd) implemented the K-12 curriculum adding two more years to basic education in lieu of the Republic Act No. 10533. This enactment aims to upgrade the Philippine basic education system by strengthening its curriculum that every completer of basic education shall be an empowered individual who has learned the competence to engage in work and be productive. The State is mandated to create a functional basic education system that will develop productive and responsible citizens equipped with essential competencies, skills, and values for lifelong learning and employment. This will broaden the goals of high school education for college preparation and entrepreneurial employment in a rapidly changing and increasingly globalized environment.

All were first-timers in the early implementation of Senior High School. There was a lack of participation of industries and work immersion venues, which was a significant gap in crafting a responsive and appropriate curriculum, including work immersion. There was not a clear framework on how the students could connect to industries for work-integrated learning. Another major challenge was the lack of policies and rules to govern the work-integrated learning program, which poses risks to students, the school, and partner industries. Coalition for Change (2018) reported that WIL program might expose students of minor age to safety and health hazards, and industries could face legal issues, potential workflow interruption, and productivity loss.

The WIL program is advantageous for students to develop relevant skills as early as high school despite the challenges. Properly implemented, WIL improves students' competencies, helps them make informed career choices, and creates employment opportunities straight out of Senior High (CFC, 2018); enables the students to acquire and develop the skills of teamwork, communication, attendance and punctuality, productivity and resilience, initiative and proactivity, judgment and decision making, dependability and reliability, attitude, and professionalism (Acut et al., 2021).

To augment the gap on policies, rules, and guidelines that govern the WIL program, the Philippines' DepEd and Department of Labor and Employment (DOLE) issued the *"Guidance to Host Establishments in Ensuring Safe Workplaces for Senior High School Students under Work Immersion Program."* This policy addressed industries' concerns on accepting students of minor age, outlined how WIL program partners should deal with students in the workplace environment, included identifying appropriate hours of duty and providing protective equipment and devices following occupational safety and health standards.

Buntting (2021) emphasized that in supporting curricular reforms, the synergistic interplay between policy, research, learning, and practice development is the key to successful implementation. Policies on the WIL program has been promulgated, but it is not implemented well. There is quite limited research in implementing the WIL program for Senior High STEM students in the Philippines. A significant goal of this study is to add up to the literature by providing relevant and timely findings on how students evaluated the program and perceived their overall performance work immersion experience. Specifically, the study addressed the research questions:

1. What are the participants' ratings and comments on the WIL program in terms of preparation, work immersion environment, relevance, delivery, and overall implementation?
2. What hard skills did the participants acquire during the WIL program?
3. What barriers did the participants anticipate that might prevent them from applying the concepts they learned in school and the WIL program in a real-life scenario? How will the participants overcome those barriers?
4. What are the factors that help the participants be successful throughout the WIL program?
5. What are the participants' suggestions on the improvement of the WIL program?

METHODS AND ANALYSIS

This study employed action research (Lewin, 1940 as cited by Dickens & Watkins, 1999; Altrichter, H., Posch, P. and Somekh, 2007) where participants underwent work immersion in partner industries outside the school premises to investigate the effectiveness of the WIL program. A descriptive research survey (Glass & Hopkins, 1984; McCombes, 2020) is also utilized to analyze the frequencies, averages, and patterns of the participants' evaluation regarding the WIL program implementation.

Participants

The respondents of this study are Grade 12 senior high school students who are enrolled in science, technology, engineering, and mathematics (STEM) strand under the Academic Track of the K-12 curriculum. Seventeen (53%) boys and fifteen (47%) girls participated in the 80 hours-work immersion. Before the WIL program, the participants and their respective guardians are oriented on the nature of the work immersion. Parents' consent forms were then distributed to seek the approval of their children's participation in the program. In the form, important information was retrieved, such as the student's name, date of birth, school, immersion site, immersion address, the name and address of the parent/guardian, and contact number. The medical background was also disclosed, asking if their children have suffered from any medical conditions/allergies that the immersion teacher should be aware of, including any current medication and medication details that must be administered.

Undertakings were also agreed, such as they (the parents) agreed that their son/daughter would take part in the work immersion as a critical feature of the senior high school curriculum, which involves hands-on experience or work simulation in which the learners can apply their competencies and acquired knowledge relevant to their track. That the parents fully support the work immersion undertaking of their son/daughter through minimal cost and their participation/presence if desired. That the parents understand that the school shall procure insurance for learners, hence, release the school, its teachers, and personnel from any liability, claims, demands, and course of action whatsoever arising out of or related to any loss, damage, or injury that their son/daughter may sustain during the work immersion. Moreover, the parents understand and agree that their son/daughter would undertake supervised travel as arranged by the school.

Curriculum Guide

Work Immersion is one of the subject requirements for graduation (DepEd, 2017). SHS students must be immersed in industries that are directly related to the student's postsecondary goals. Through the WIL program, the students are exposed to and become familiar with the work-related environment related to their field of specialization to hone their competence. Specifically, the students can:

1. Gain relevant and practical industrial skills with the guidance of industry experts and workers.
2. Recognize the importance and application of the principles and theories taught in school.
3. Enhance technical knowledge and skills.
4. Enrich skills in communications and human relations.
5. Develop effective work habits, attitudes, appreciation, and respect for work.

This work immersion curriculum prepares the students to meet the needs and challenges of employment or higher education after graduation. A pre-immersion orientation was conducted to let the participants understand the work immersion by discussing the expected behavior such as work ethics, safety, workplace rights and responsibilities, confidentiality in the workplace, and functional conflict resolution and teamwork skills. Other than that, work immersion rules and regulations, terms, and conditions of the Memorandum of Agreement were also discussed. Participants were immersed in appreciating the importance of credentials by writing a resume, filling out application forms, visiting the concerned offices where the clearance documents could be secured, and training in job interview skills to simulate the actual working conditions. Subsequently, the work immersion teacher discussed the portfolio instructions to which the participants will be submitting at the end of the program implementation. Instructions include the content of the portfolio consisting of accomplished forms, pictures of the work site, and non-written output/projects with captions, illustrations of activities performed as needed, narrative and account of learnings and achievements, issues faced and corresponding solutions, work immersion highlights, and other relevant documents.

Table 1. Snippet of WIL Program Curriculum Guide

Objectives/Learning Area	No. of Hours	Teacher's Activity	Learners' Activity	Learners' Output
I. Pre-Immersion A. Understanding work immersion by discussing: 1. Expected behavior a. Work ethics b. Safety in the workplace c. Workplace rights and responsibilities d. Confidentiality in the workplace e. Effective conflict resolution and teamwork skills 2. Work immersion rules and regulations 3. Terms and conditions of the Memorandum of Agreement	6 hours 6 hours	The teacher: 1. conducts the preImmersion orientation 2. guides the students in securing and accomplishing forms 3. validates the accomplished forms 4. provides a checklist containing things to do and documents needed for pre-immersion, during, and after Immersion	The student: 1. attends the pre-Immersion orientation 2. prepares and secures required documents	1. essay on the how to conduct oneself inside the company/ business establishment during the Immersion period 2. résumé 3. application 4. clearance documents
II. Immersion Proper A. Appreciating management processes by observing, identifying and describing the following: 1. Nature of the business 2. Description of the products/services 3. Target clientele 4. Organizational structure 5. Company rules and regulations		The teacher: 1. coordinates with the organization/ establishment 2. monitors the students' progress 3. provides interventions for students, if necessary 4. provides general supervision to the students	The student: 1. reports to the company based on agreed time frame 2. receives orientation from the company/ establishment on the nature of the business, description of the product/ services, target clientele, organizational structure, and rules and regulations	1. written narrative on the profile of the company/ business establishment (may contain charts, photos, or illustrations) 2. written report on the activities performed 3. supervisor's rating 4. organizational chart

Note. Adapted from Department of Education (DepEd) Work Immersion Curriculum Guide (2017)

Table 2. Snippet of the List of Tasks and Activities of Work Immersion Students during Immersion Proper

Company/Department	Students' Tasks/Activities	Competencies
Cosmetics Manufacturing QUALITY ASSURANCE AND QUALITY CONTROL DEPARTMENT Time Allocation: 72 hours	1. performs hands-on activities that are related to the skill acquired in his/her chosen field of specialization 2. performs other required tasks based on the agreement 3. renders reports to the teacher and the industry supervisor for immersion 4. records the daily tasks performed	1. Raw Materials Quality Check 2. Packaging Materials Quality Check 3. In-Process Quality Check 4. Finished Product Quality Check 5. pH Testing for Raw and Finished Products 6. Density Testing for Raw and Finished Products 7. Viscosity Testing for Raw and Finished Products 8. Microbial Testing of Finished Products 9. Filling out Production Quality Control Card 10. Filling out Process Card 11. Measuring Temperature and Relative Humidity of Production Rooms 12. pH and conductivity testing of Deionized and Reverse Osmosis Water 13. Employee PPE Check-up
Architectural Engineering ARCHITECTURAL DESIGN DEPARTMENT Time Allocation: 72 hours	1. performs hands-on activities that are related to the skill acquired in his/her chosen field of specialization 2. performs other required tasks based on the agreement 3. renders reports to the teacher and the industry supervisor for immersion 4. records the daily tasks performed	1. Supervising the Workplace 2. Basic Drafting using AutoCAD 3. Site visit – Construction site observation 4. Basic Drafting using SketchUP 5. Computer Shop Design using AutoCAD and Sketch 6. Stockroom Material Check-up 7. Common Engineering theories

Table 2. Snippet of the List of Tasks and Activities of Work Immersion Students during Immersion Proper (continued)

Company/Department	Students' Tasks/Activities	Competencies
Agriculture EXPERIMENT STATION DEPARTMENT, CROP PROTECTION CENTER, SOILS LABORATORY DEPARTMENT Time Allocation: 72 hours	1. performs hands-on activities that are related to the skill acquired in his/her chosen field of specialization 2. performs other required tasks based on the agreement 3. renders reports to the teacher and the industry supervisor for immersion 4. records the daily tasks performed	1. General assistance in the laboratory and/or field 2. Potting banana plantlets 3. Hydroponics 4. Urban Gardening 5. Budding And Grafting of plants 6. Tissue Culture Laboratory 7. Carbonating Rice Hull 8. Soil Science 9. Herbs And Spices 10. Herb Propagation 11. Plant Labelling
Electronics Engineering TEST ENGINEERING DEPARTMENT Time Allocation: 72 hours	1. performs hands-on activities that are related to the skill acquired in his/her chosen field of specialization 2. performs other required tasks based on the agreement 3. renders reports to the teacher and the industry supervisor for immersion 4. records the daily tasks performed 5. performs and participates the activities in test equipment, test process, rubber seal fabrication, document generation, coupler preventive maintenance, connector fabrication and documentation, equipment build training	1. Job description discussion 2. Test engineering trainings 3. Overview of the Test Process 4. Overview of the Test Equipment 5. Rubber Seal Fabrication Training 6. Document Generation Training 7. Coupler Preventive Maintenance 8. Connector Fabrication and Documentation 9. Equipment Build Training

During the immersion proper, participants appreciated the management processes of the work immersion venue by observing, identifying, and reporting the nature of business, description of the products and services, target clientele, industry's organizational structure, and company rules and regulations. Work immersion students also observed and participated in the companies' safety, production, maintenance, quality control, quality assurance, customer satisfaction, housekeeping, and hygiene (Rodriguez, 2017; Fleming & Hay, 2021). The majority of the work immersion period was allocated to applying skills learned and proper values acquired in school.

A post immersion phase was implemented in the WIL program, and the work immersion experiences were evaluated by letting the participants present a portfolio with weekly diary entries, compare and contrast school work and application of skill, knowledge, and attitudes, write an updated resume, and reflect on the work immersion experiences.

Partner Industries

As per DepEd's Guidelines to K to 12 Partnerships (2015), a school needs to establish partnerships for work immersion opportunities for its students, use of facilities and additional resources to attain one of the objectives of the K-12 Curriculum to develop students who have knowledge, skills, and values to pursue a college education and training or to enter to the world of work through employment or entrepreneurship. For this WIL program, the partner industries include - electronics manufacturing, the agricultural sector, cosmetics manufacturing, and architectural and engineering services.

Table 3. Science, technology, and engineering partner industries during the WIL program

Work Immersion Venue	No. of Participants (n=32)	Description/Nature of Business
Electronics and Engineering	15	Market leader and global provider of advanced micro-acoustic, audio-processing, and precision device solutions, serving the mobile consumer electronics, communications, medical, military, aerospace, and industrial markets.
Agriculture	14	Executive department of the Philippine government responsible for the promotion of agricultural and fisheries development and growth.

Cosmetics	1	Focused on the production of skin care, personal care, hair care, toiletries, and colour cosmetics products.
Architectural Engineering	2	Builds affordable projects, linking their professional approach in Autodesk, computer-aided design, 3D Studio, structural mapping, land desktops, and project management.

A memorandum of agreement (MOA) for work immersion partnership was signed by the school and partner industries. Stipulated in the MOA is the witnesseth, description of the work immersion program, objectives of the work immersion partnership, responsibilities of the parties, effectivity, liability, non-disclosure provision, and other provisions. This agreement led to the formation of the WIL program steering committee, which is tasked to supervise the entire duration of the work immersion partnership. The school administrator and school head shall be the authorized persons to sign the MOA with the Partner Institution on behalf of the school and ensure that all provisions in the MOA are adhered to by both parties.

The Work Immersion Focal Person (WIFP) shall manage the conduct of Work Immersion, establish/pursue and maintain the Work Immersion partnership between the School and Partners Institutions, use evaluation and monitoring results to recommend decisions on partnerships. Likewise, the WIFP shall coordinate with the Work Immersion Teachers regarding the placement of students in partner institutions, consolidate reports from Work Immersion Teacher, and conduct regular ocular inspections with the Work Immersion Teacher to ensure that the work immersion venue is safe, secure, and suitable for learning. On the other hand, the Work Immersion Teacher (WIT) shall supervise learners doing work immersion in coordination with the Work Immersion Supervisor, coordinate with the Work Immersion Focal Person learner's activities, class, and venue schedules. Moreover, the WIT shall conduct Pre-immersion and Post-immersion activities, conduct regular visits to the venue to ensure that learners' activities are appropriately implemented, submit reports regularly to the Work Immersion Focal Person on the completion and performance of learners, performance of the Partner Institution, and issues and concerns.

The steering committee includes the partner institution, company work immersion coordinator, and work immersion supervisor in the company. The partner institution shall be the authorized persons to sign the MOA with Partner School on behalf of the work immersion company and ensure that all provisions in the MOA are adhered to by both parties. The

Company Work Immersion Coordinator (CWIC) shall supervise Work Immersion Supervisor during Work Immersion, coordinate with the School Work Immersion Focal Person and Work Immersion Teacher on Work Immersion Venue schedules and capacities, provide input in the Pre-immersion and Post-immersion activities and schedule the learner's activities in the Work Immersion Venue. Lastly, the Work Immersion Supervisors (WIS) Shall supervise learners during Work Immersion, coordinate with the School Work Immersion Focal Person and Work Immersion Teacher on Work Immersion Venue schedules, and capacities, provide input in the Pre-immersion and Post-immersion activities. Additionally, the WIS is assigned to schedule the learner's activities in the Work Immersion Venue and the Work Immersion Focal Person and Work Immersion Teacher, informing the Work Immersion Teacher on capacities, Immersion completion performance of learners, and issues and concerns.

Survey Questionnaire

The questionnaire is composed of a rating scale and open-ended questions. The content is according to DepEd's guidelines on WIL program monitoring. Before the distribution of this instrument, this was face-validated and pilot- tested. The questionnaire underwent evaluation and revision to ensure comprehensiveness, reliability, and error-free. Participants should indicate to what degree they agree with each situation and comment on improving the WIL program in the subsequent implementation.

Table 4. Snippet of the WIL Program Survey Questionnaire for the Participants

Area	No. of Statements	Sample Item
Preparation	2	The skills I have learned in my specialization subjects have prepared me for Work Immersion.
Work Immersion Environment	2	The work immersion venue helped me acquire skills/competencies.
Relevance	2	The work immersion will be helpful for my success in the future
Delivery	3	I was given adequate opportunity to perform hands-on activities that are related to my specialization
Overall Implementation	4	The work immersion met my expectations.

There are five areas evaluated, namely - preparation, work immersion environment, relevance, delivery, and overall implementation. A total of thirteen (13) situations are included in the rating scale. Scales included are 1 for strongly disagree, 2 for disagree, 3 for agree, and 4 for strongly agree. Three (3) open-ended questions on the barriers to the application of work immersion, and comments on how to improve the program. Lastly, students are required to enumerate the factors that affect their successful work immersion experience.

Data Analysis

In the evaluation of the WIL program, the weighted means were used to analyze the ratings of the participants regarding the areas of work immersion. To interpret the mean ratings, the scales 1.00-1.50, 1.51-2.50, 2.51-3.50, and 3.51-4.00 were used with the following descriptions - poor, fair, good, and excellent, respectively. Standard deviation is also computed to see the dispersion of the ratings. Thematic analysis is used to organize the students' comments on the four (4) areas of the program, and participants' comments on how to improve the work immersion. For the factors affecting the successful WIL experience, the frequency distribution is utilized. All the numerical data gathered were processed using the Google Sheet program for Windows.

Ethical Considerations

The respondents have the right to decide whether or not they will be involved in this research. Before consent was sought, researchers gave details of the nature and purpose of research, who will have access to the gathered data, and the proposed outcome of the research. Before data gathering, respondents were given a consent form to confirm their participation; therefore, completion of the questionnaire was taken as their giving consent. Respondents had the option to indicate their names to keep their identity. However, the Learner Reference Number (LRN) was necessary in case of an error in completing data. In the entire course of the study, it was emphasized that all the gathered data would be treated with the utmost confidentiality and be exclusively used for the purpose of this research. The school's guidelines on data privacy are strictly followed and ethical approval was sought and granted.

RESULTS AND FINDINGS

The data gathered were drawn from the survey questionnaire and was analyzed accordingly. This portion presents the participants' evaluation of the implemented WIL program, the hard skills acquired, the barriers anticipated preventing the work immersion students to use the acquired skills, the mechanisms on how to overcome the barriers, and the factors that helped the work immersion students throughout the intervention, and the suggestions that could help in the next implementation of WIL.

Implementation of Work-Integrated Learning Program

After the duration of the program, participants were asked to think about the work-integrated learning they completed and indicate to what degree they agreed with each situation provided to them - preparation, work immersion environment, relevance, delivery, and overall implementation. Additionally, the participants provided comments and ratings to help improve the work-integrated learning program in the future.

Table 5. Participants' Ratings after the Implementation of WIL Program

Area	Mean (μ)	SD (σ)	Interpretation
Preparation	3.52	0.50	Excellent
Work Immersion Environment	3.54	0.54	Excellent
Relevance	3.42	0.50	Excellent
Delivery	3.56	0.57	Excellent
Overall Implementation	3.54	0.52	Excellent
Average	**3.52**	**0.53**	**Excellent**

In *preparation*, results revealed that the participants strongly agreed (μ=3.52) that the skills they have learned in their specialization subjects have prepared them for work immersion. The school conducted the pre-immersion orientation and guided them in securing the necessary documents (i.e., resume, application letter, barangay clearance, police clearance, medical certificate).

> *Our work immersion teacher and the school were able to orient us about the requirements and tasks appropriately involved. (P1, P2, P5, P13, P14, P22)*
> *The chemistry lab in school helped me know how to work in the soil analysis lab I was assigned in. (P12, P13, P17, P18, P32)*
>
> *The knowledge, skills, and attitude I have learned in school were a big help. (P19, P22, P29, P30)*

When participants were questioned if the *work immersion environment* helped them acquire new skills and competencies, and if no significant distractions interfered during the entire training, they strongly agreed (μ=3.54).

The workplace was very good and the employees were helpful. (P1, P5, P6, P12, P14)

So far, everything was well-organized and they were able to teach me technical and interpersonal skills. (P2, P10, P15, P16, P24, P28, P32)

The work immersion venue made me familiar with a couple of laboratory protocols and skills, and it was pretty much working from then on. (P13, P22, P25, P26, P29)

Having a mean of 3.42 for *relevance*, participants strongly agreed that the work immersion will be helpful for their successes in the future and that they will be able to immediately use what they have learned in the work-integrated learning program.

I tried to internalize what I have learned in the company since I would be pursuing Veterinary Medicine. (P13)

I was able to widen my view about the real world. (P5, P14, P17, P18, P20, P28, P31, P32)

The things I learned are applicable and useful for all. (P3, P4, P6, P8, P11, P14, P20, P26, P27, P28, P30, P31)

Being in the laboratory is such a huge help for my future because I will be taking a course in medical sciences. (P22)

For the *delivery* of the program, students also strongly agreed (μ=3.56) that they were well-engaged with what was going on during the work immersion; the activities aided their learning. Participants were given adequate opportunities to perform hands-on activities that are related to their specialization.

My mentor did well in explaining their daily activities in their department and let me try to do their tasks. (P1, P4, P5, P8, P9, P12, P18, P23, P24, P29)

I enjoyed my time in the work immersion venue. (P2, P6, P13, P30, P31)

Everything was executed well and there was equity since everyone got to perform. (P7, P22, P28, P32)

When it comes to the *overall implementation*, participants strongly agreed to the success and overall implementation of the work-integrated learning program with a mean of 3.54. The work immersion met their expectations and they are clear on applying what they have learned in the job. They will recommend the work immersion venue to other learners who will soon be taking the Work Immersion subject and whose specialization is the same as theirs, which is STEM. Moreover, they will also endorse STEM to other learners who are still thinking about what strand to specialize in when they reach senior high school.

> *I had a great time. It was a very enriching experience! (P1, P3, P13, P24, P30, P32)*
>
> *I was able to generate new decisions for my future career. (P2, P7, P10, P14, P17)*
>
> *Work immersion gives you the opportunity to be in the workplace. You will meet different people and learn a whole lot. (P5, P8, P11, P21, P29)*
>
> *I will recommend this work immersion venue to the upcoming Grade 12 students. (P4, P13, P22, P26, P27)*

Hard skills acquire during the WIL program

Students who were immersed in the different departments of the four (4) partner industries during the WIL program acquired the set of hard skills they considered as early training since they will be pursuing a college education related to their place of assignment in the work immersion.

Table 6. Hard Skills acquired after the Implementation of WIL Program

Industry and Department	**N=32***	**Hard Skills Acquired**	**Remarks/ Grade**
Cosmetics Manufacturing QUALITY ASSURANCE AND QUALITY CONTROL DEPARTMENT	1	Raw and Packaging Materials, Inprocess and Finished Product Quality Check; pH, density, viscosity, microbial testing for raw and finished products; Filling out Process and Production Quality Control cards; Measuring temperature and relative humidity of production rooms, pH and conductivity testing of deionized and reverse osmosis water; and Employee PPE check-up	Excellent
Architectural	2	Workplace supervising; basic drafting and computer	Excellent

Engineering ARCHITECTURAL DESIGN DEPARTMENT		shop designing using AutoCAd and SketchUP; Construction site supervision; stockroom material check-up	
Agriculture EXPERIMENT STATION DEPARTMENT, CROP PROTECTION CENTER, SOILS LABORATORY DEPARTMENT	14	Assisting lab experiments and analysis; Urban gardening; Hydroponics; Budding and grafting of plants; Tissue culture; Carbonating rice hull; soil science, testing and analysis; herbs and spices propagation	Excellent
Electronics Engineering TEST ENGINEERING DEPARTMENT	4	Test engineering trainings; Test equipments and processing; rubber seal fabrication training; document generation training; coupler preventive maintenance; connector fabrication and documentation; equipment build training	Excellent
Electronics Engineering INFORMATION TECHNOLOGY DEPARTMENT	3	Creating basic HTML page; Creating web page with log-in and landing page; IT web page layouting; CSS; JavaScript; Animations;	Excellent
Electronics Engineering FACILITIES/PROCESS DEPARTMENT	2	Machine monitoring (Chillers, Air Compressors, Air Dryers, Pumps and Room Condition); Assisting in building and grounds maintenance; Measuring equipment functions and applications (FLUKE Infrared Thermography Camera, FLUKE Particle Counter, FLUKE Air Meter and KIMO Air meter); Project Management and Execution procedures; Automation, New Tool Design, Basic Programming; Problem Solving Analysis (DMAIC Approach, Ishikawa Diagram, 8D Analysis, Tree Diagram, 5 Why Analysis); Production Process Observation (Subline Process, Tab Assembly, Tube Weld, Dia Forming, Pierce and Test)	Excellent
Electronics Engineering FINANCE DEPARTMENT	4	Finance function and Systems (Oracle and Blackline); AP Process (Local and Foreign, Disbursement); AR/Sales/KEPL and Revod Accounting; Miscellaneous Tasks; Taxation; Business Control overview; Fixed Asset Management; Non-capital Asset Management; Financial Reporting Shared Services	Excellent
Electronics Engineering HUMAN RESOURCE DEPARTMENT	2	Organizational Structure; Dress code and Behavior; Trainee's Expectations; Recruitment Purpose and Overview; Recruitment Process and Policies; Documentations involved in Recruitment; Recruitment	Excellent

**N - Number of Participants*

It is important to note that participants in the agriculture industry were immersed in the three (3) different laboratories as per the suggestion of their work immersion focal person and as agreed by the school. All the students were rated "Excellent" by their respective work immersion supervisors (WIS) after they performed the tasks assigned to them.

Barriers anticipated and how to overcome them

Participants were asked if they anticipated barriers preventing them from applying what they have learned in the WIL program. Their responses include that they might take up a different career in college. Others are still undecided on what course to pursue. Their laziness and procrastination habits, incompetence, and pessimistic attitude might hamper continuing the activities they have gained in the work immersion. Another response that should be noted is that most of the participants will pursue a college education, which will prevent them from applying the skills they have acquired in the partner industries.

> *My choice of college course is the biggest concern as I am yet to decide on it. (P2)*
>
> *The only barriers I see are laziness and procrastination. (P3)*
>
> *Pursuing other studies that would offer me better opportunities. (P4, P12, P13)*
>
> *The things I learned are practical but I will not be working anytime soon. When the time comes, the process I have learned might become outdated. (P6, P9, P12, P19, P32)*

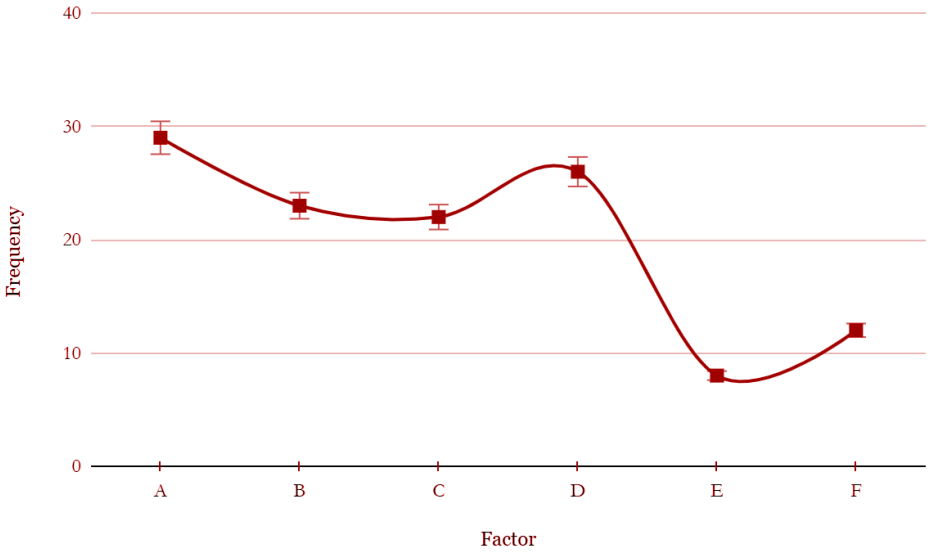
To overcome the barriers, they noted that:

> *Maybe a longer exposure to the workplace would help. (P12, P15, P16, P22, P25)*
>
> *Talking to more professionals and guidance counselors would feel like I would make a stronger decision towards pursuing agricultural services. (P13, P17, P18)*
>
> *Confidence in my overall abilities and to get lessons from mentors would be of great help. (P3, P10, P14, P28, P31)*

Although one of the goals of the WIL program is to produce basic education graduates equipped with working skills, this would not apply to STEM students since they need more formal training before joining the field of work. Participants are fully aware of the barriers that stop them from using those acquired working skills, but they provide mechanisms to overcome and discover themselves applying them. To overcome those barriers, they suggested looking for ways to apply the skills by seeking part-time jobs to perform related tasks in the WIL program, talking to professionals and career guidance counselors, longer duration of work immersion, hard work and determination, and by pursuing careers and courses the same or if not directly related to the role that they have experienced during the WIL course.

Factors affecting participants' successful experiences

The participants were asked to enumerate the factors that affected their work immersion experience in their respective work immersion venues and the results are shown below.



Legend: A - Coaching from work immersion supervisor; B - Support and/or encouragement; C - Effective system of accountability or monitoring; D - Resources to apply what they have learned; E - Willing and participation of oneself; F - Company's WIL program

Figure 1. Factors affecting the successful WIL Program

Based on the figure, twenty-nine (91%) participants identified that coaching from their work immersion supervisor played an essential role in the success of the work immersion program. Next is the available resources in the partner industries where they could apply what they have learned with twenty-six (81%) frequency. Another factor is the support and encouragement of teachers, classmates, and people in the work immersion venue, having twenty-three (72%) frequency. The effective system of accountability and monitoring also aided the success of the WIL program with a frequency of twenty-two (69%). The company's

existing WIL program and willingness and participation of oneself played a vital role with a frequency of twelve (38%) and eight (25%), respectively.

Improvement of WIL program

The participants enlisted their comments on how to improve the implementation of the WIL program. These include:

- Longer duration of work immersion (more than 80 hours);
- Improve schedule flexibility; and
- Frequent feedbacking

The majority of the participants proposed extending the duration of the work immersion to more than 80 hours to have ample time immersing for better learning and working experience. Improving the work immersion schedule is of great concern in order not to affect other subjects' schedules. The participants also requested frequent feedback regarding the updates of their work immersion so that they may be on track on the documents and requirements needed to attain.

DISCUSSION

Work immersion is a requirement for graduation from secondary education, where learners are immersed in an actual work environment (DepEd, 2017). WIL program has been incorporated into the K to 12 curriculum to achieve greater congruence between basic education and the nation's development targets.

The implementation of the WIL program is successful and relevant based on the evaluation of the participants. The preparation criterion can imply that the school prepared the participants before immersing them in the partner industries. The WIT conducted the pre-immersion orientation, guided the students in securing and accomplishing required forms, and validated the accomplished forms. The WIT also provided a checklist containing things to do and documents needed for pre-immersion, during, and after Immersion. On the other hand, the participants attended the pre-immersion orientation, prepared and secured required documents, and wrote an essay on how to conduct themselves inside the company during the immersion period. The students also prepared their resumes and application letters.

A similar study by Acar (2019) revealed that immersion students (n=100) were highly satisfied with the delivery and work immersion environment. The workplace has enabled them to appreciate the world of work and the actual tools being used. They were also aided with their learning and given opportunities to perform hands-on activities that they can learn. Students' satisfaction with the work immersion program constitutes improved personal skills, technical skills, and work applicability. In addition, a work immersion program would help

students trust their abilities and develop their self-confidence, which would encourage them to be motivated to pursue post-secondary ambitions (Garcia & Yazon, 2020).

Among the factors that affected participants' successful WIL program, the coaching from their respective work immersion supervisor ranked first. Since their mentors directly supervise students, it can be implied that the participants got hands-on experience and real job exposure. In the adjunct study of Acut et al. (2021), twenty-five (25) Grade 12 STEM students were immersed in science and technology-based industries for eighty (80) hours. After the immersion, the supervisors evaluated the students' performance as "outstanding" and that their performance exceeds the required standard. The positive learning gains suggested that work immersion enabled the students to acquire and develop teamwork, communication, attendance and punctuality, productivity and resilience, initiative and proactivity, judgment and decision making, dependability and reliability, attitude, and professionalism. Moreover, students who were exposed to laboratories applied what they have learned and created their own gel electrophoresis apparatus that is used to separate different molecules. The project was made of home-made materials and followed the do-it-yourself method (Gamale et al., 2021). In a recent study of Lim et al. (2020), students reported self-perceived improvements after the integrated work-study program (IWSP) in their work-related skills, encompassing six domains – learning & work integration; professionalism; communication; problem-solving and decision-making; teamwork; and adaptability. The study investigated the impact of the IWSP on students' self-perceived growth compared to their supervisors' perception of them and whether mindset contributes to this. Results further revealed that work supervisors rated students even more positively on all work-related skill domains, with an exception for ratings in problem-solving and decision-making being similar to how students rated themselves after the IWSP. It was also observed that students with a growth mindset received better ratings from their work supervisors in problem-solving and decision-making.

In spite of the collaborative efforts between school and stakeholders in linking students to industries through the WIL program to prepare students to be work-ready, work immersion students (n=32) find themselves unable to apply what they have acquired in the work immersion. Since they will not be working any time soon and others are not confident in their abilities, most of the respondents in this study would pursue a college education. Orbeta et al. (2018) from the Philippine Institute for Development Studies reported that among the 18 schools in the Philippines that were part of the study, 75.4% would go to college as their plan after graduating from Grade 12. Only 10% would get a job, 13.7% would work and study, and 0.9% are still undecided. This study included Grade 12 STEM students with a population of approximately 192,624. To add, Acar (2019) further reported that of the 143 respondents in the study, 93% would pursue a college degree, 47% of them would take STEM-related courses.

For those STEM students who are not confident to work after they graduate from Senior High School (SHS), their whereabouts could be attributed to the employment culture in the country. Industries require a college graduate to join the world of the workforce. Orbeta et al. (2018) revealed that although employers know the SHS curriculum or specialization and the quality of the first batch of Grade 12 graduates, these credits are not adequate. Nevertheless, out of the 26 industries included in the study, 92% are willing to hire SHS graduates. However, there are preconditions for hiring them, requiring competencies and specialized skills, improved work immersion, and offering only low positions. Those willing to hire mainly were from business process outsourcing (BPO), manufacturing, professional services, and retail. These employers said that available jobs were entry-level positions in administrative work, customer service, and sales and marketing (Orbeta et al., 2018). In contrast, the Grade 12 STEM Curriculum is not aligned to these kinds of jobs. A report from the Coalitions for Change (2018) showed that out of 212,000 Grades 11 and 12 students who completed the work immersion program in Central Visayas Region, Philippines, 60% in the region were now employed. However, most of them are in the tourism industry, not in science, technology, and engineering. The organization, however, added that students who plan to proceed to higher education also now have the advantage armed with the knowledge and experience from the WIL program.

The majority of the work immersion commented that the 80-hour WIL program is insufficient. Thus, an extension is needed to give them ample time to apply and test their skills and lengthen their work experience in their respective work immersion venues (companies). As per DepEd's Work Immersion Guidelines (2017), the department only required a minimum of 80-hours of work immersion for the Academic track (including STEM strand). However, they provided other schemes on the duration of the work immersion longer than 80-hours vis a vis on the agreement between the school and partner industries. In the school where this current study is conducted, it only follows the minimum number of hours required by DepEd to not disrupt the school calendar activities. At the same time, conflicts on work immersion schedules and other subjects offered in the same semester are being considered. The partner industries required the students, as per MOA, to work from 8:00 AM to 4:00 PM (with a lunch break and snacks break in the morning and afternoon) following Monday to Friday schedule. So the participants would miss other subjects taught in school. The school initiated an intervention to give way for the work immersion. All subjects (except Work Immersion) were on-freeze for approximately two weeks and resumed after the students completed their 80-hour work immersion. Through this, students would have an undisrupted work immersion schedule. The intervention was just a short-term solution to the problem. If the partner industries require more than an 80-hour work immersion, freezing other subjects to allow the immersion is not ideal. This challenge further gave insights to the school administrator to have work immersion during summer to not disrupt other subjects'

classes and the school calendar. And the school in coordination with the partner industries could agree to a longer duration of work immersion program. In addition, monitoring form questionnaires were developed to address the gap in the feedbacking mechanism between teachers to students, supervisors to students, schools to partner industries, and vice versa.

CONCLUSION

The Work Immersion Curriculum promises to offer students further education that serves their interests, equips them with specialized skills and knowledge, proper attitude, work-ready and makes them internationally recognized. Notwithstanding, the implementation is still a work in progress. To address the challenges, work immersion stakeholders should consider making enhancements to the curriculum (involve the companies/industries in this undertaking), impose localized guidelines of work immersion fit for the schools and their partner industries, and support the professional growth of work immersion teachers and work immersion supervisors.

Based on the findings of this study and previous researches conducted regarding the work immersion curriculum in the Philippines, the following lessons can be considered for future implementations:

- The partner industries/companies as hosts for the WIL program are potential agents to holistic and realistic education and an instrument to the overall development of human capital. Thus, their specialized knowledge is significant to curricular reforms in work immersion that will aid the students to hone their soft and hard skills needed in the workplace and college.
- Local Government Units (LGUs), Local Industries/Companies, and Department of Education - Division offices should create continuous opportunities for coordination and collaboration. Their insights and interventions towards the WIL program are significant components in the success of the implementation.
- The Schools are considered nursery areas where students' knowledge, skills, and attitude are being honed. Teachers and education practitioners should seek further professional growth and development to upskill themselves and be at par in delivering the curriculum. Administrators, likewise, should plan and collaborate with more partner industries to cater to students' needs and interests. Immerse the students in relevant work immersion venues for a meaningful learning experience and not just for compliance purposes.
- Parents and Guardians of work immersion students play a critical role in the WIL curriculum. Their guidance and full support of the program could lead to positive and meaningful outcomes.
- The Department of Education (DepEd) should provide a constructive feedback mechanism after completing the WIL program and submitting the required

documents. Through this, the schools would conduct a frequent inventory and checkup of their respective WIL programs.

True to its objectives, the WIL program of the DepEd prepares STEM students to become work-ready equipped with the knowledge, attitude, and skills (technological, scientific, and environmentally aware). Though STEM students planned to pursue a college education, the learnings they acquired in the industry could be used once they have the internship/work placement program of their college courses. The hard skills which include urban gardening, carbonating rice hull, performing tissue culture experiments, rubber seal fabricating, test engineering, drafting using AutoCAD, pH and microbial testing, and others might not be practiced anytime soon. However, the soft skills (teamwork, communication, attendance and punctuality, productivity and resilience, initiative and proactivity, judgment and decision making, dependability and reliability, attitude, and professionalism) will be with them as they pursue higher degrees in tertiary education.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the FORUM school administration, work immersion supervisors of partner industries, and students who participated in the work-integrated learning program.

CONFLICTS OF INTEREST

The author declares no conflict of interest in this study.

DISCLAIMER STATEMENT

The author hereby declares that this paper is his original research work. Results and findings were gathered from the outcomes of the WIL program he is associated with. All text either quoted directly or paraphrased have been properly cited and fully referenced.

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