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Improving Technical and Report Writing Skills of Transition Students by incorporating Solo Taxonomy and Problem-Based Learning

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Abstract

Vocational Courses give some amount of technical skills for students to be able to work in industry. However, to achieve higher income and higher sense of achievement, a bachelor's degree is imperative these days. Many students who have completed their vocational courses thus join Top UP Programme to achieve this goal. In computing curriculum, an advanced module "Web and Systems Based Programming" is introduced to them which has a Summative Assessment that includes a Report and an advanced Website creation. Being from varied universities, their curriculum not necessarily have included the pre-requisite modules and skills. These technologies are also important for these Computing would-be-graduate soon for their Employability in Industry. As a tutor and evaluator, it poses a challenging task to make such Top UP students in par with the regular students. The undertaken Action Research (AR) Project aimed to make Top Up students work on the current trends of Web Development Technologies using prerequisite subjects [HTML, CSS, PHP] and Report Writing Skills by applying the curriculum models for this process with SOLO taxonomy and Problem Based Learning. Based on the AR project and from overall assessment, it was realized that the project facilitated the pupils to develop and enhance employability skills, and knowledge of problem-based learning. The product and process curriculum model, problem-based learning, multiple formative feedback and learning through peers promoted the TOP Up learners to come in par with the regular students.

***Keywords*:** Action Research, Transition Students, Problem based learning, Solo Taxonomy

1. Introduction

1.1. Research Background

Many students achieve their diploma from vocational courses such as Higher National Diploma Awards for Training and Higher Education and other awarding bodies. They then enroll in Universities to complete graduation. Such students are referred to as either "Vocational" or "Top UP" or "Transition students". However, vocational or Top Up students face numerous obstacles when transitioning to university. Some normally acknowledged obstacles refer to information processing capabilities (White, 2014) and university standards related to acquiring and integrating information as a way in the learning procedure. These aspects affect explicitly on equipping transfer learners and their acceptance to higher-level education work (Eggleston et al., 2001). University teachers need to be active members in this method to aid learners' training in higher standards (Townsend et al., 1993).

1.2.Problem Identified

The Course is BSc. (HONS) Computing Top Up Degree Programme of Year 3. The students join Top Up after having completed their Higher National Diploma (HND) or ATHE Level 5 (Computing). The module under consideration is CPU6003 - Web and Systems Development. The Summative Assessment includes implementing a Website with

Webservices and a Report.

This module requires the prerequisite knowledge of basic web programming modules like HTML, CSS, PHP. Being from other Universities and transition from HND or ATHE, many students do not have these prerequisite programming modules in their curriculum. Many are unfamiliar with concepts of academic writing in terms of plagiarism and referencing.

A basic challenge in learning programming is that (Malik, 2018) many varied sets of proficiencies need to be achieved simultaneously. Learners need to study the syntax and semantics of a coding technique and to evolve suitable problem-solving capabilities.

1.3. Aim of Action Research

The undertaken Action Research Project aimed to make Top Up students work on the current trends of Web Development Technologies using prerequisite subjects [HTML, CSS, PHP] and Report Writing Skills by applying the curriculum models for this process with SOLO taxonomy and Problem Based Learning.

1.4. Objectives of AR

The objectives of the research for Improving Web development and report writing skills are as follows:

1. To apply SOLO taxonomy, problem-based learning
2. To implement learning with peers and multiple formative assessments and feedback

3. To analyze and compare results of current batch with previous batch for report writing skills and web development skills and inspect Learner's Enhancement
4. To evaluate and recommend areas for further development.

1.5. Curriculum Theory

Curriculum stems from the Latin term "*currere"* denoting 'to run'. The purpose of a curriculum (McKimm, 2007) is to offer a guideline which aids learning. The Curricula can achieve this purpose by enhancing the student's knowledge, expertise and approach towards problem solving. It should outline the Topics to be taught as Indicative Content, the Learning Outcomes, Learning and Teaching Strategy, Learning & Teaching Methods, Learning Resources with respect to some Books, Journals or Articles, methods of learning and assessments.

The curriculum (Prideaux, 2003) should be open to discussion, easily disseminated to the stakeholders linked with the learning community, welcoming reviews, and agile to voluntarily bring good practices into implementation.

Three levels exist of a curriculum: what is

- intended for the learners,
- delivered to the learners, and
- the students experience.

1.6. Curriculum models

There are four Curriculum models where Curriculum is expressed as:

- Means to **transmit knowledge** based on transferring a given syllabus.
- **"Product"** - an effort to obtain specific goals in learners based on Learning Outcomes
- **"Process"** – presents prospects for pupils to recognize their learning necessities based on learning abilities and reflection as part of the appraisal process.
- **"Praxis"** - curriculum progresses using the active collaboration of action and reflection

The **Process and Product** model of curriculum is used for this project as it requires me to modify my teaching and assessing approach while keeping the learning objectives as the goals to achieve for the TOP UP and regular students as well.

1.7.Action Research

Action research, according to (Arnold and Norton, 2018), is a kind of investigation that is:

"practical" since it includes transformation of practice.

"theoretical" since it is guided by theory and can create novel perceptions.

"collaborative" since it inspires involvement with others in the procedure.

"reflexive" since it entails practicing investigators to review their information, ideals, and skilled actions.

"contextual" since it concedes institutional, state and social impacts.

"Action research is based on appraising your practice to verify if it satisfies your ideal standards, recognising domains that can be enhanced, and devising techniques to enhance them." (McNiff, 2017)

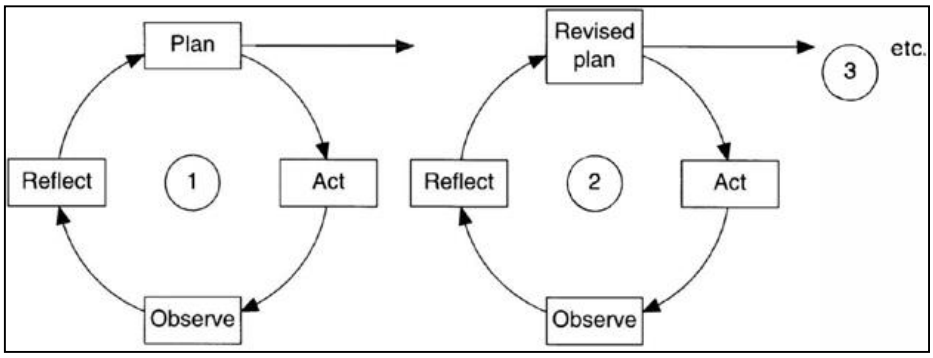


Figure 1: Action Research Cycle (Curtis et al., 1999)

In higher education, action research has been linked with research associated to an array of problems and difficulties. (Gibbs et al., 2017) classify the method as used in connection with the matters of social righteousness in higher education, organizational progress, curriculum growth, and pioneering and critical pedagogies.

The basic phases of Action Research (Arnold and Norton, 2018) are:

- Observe self-practice and examine areas for improvement
- Reflect on mode of operation and recognize probable actions to improve practice
- Actualize an action

- Analytically appraise the action
- Articulate learning from the process
- Re-examine practice and contemplate prospects for another research loop.

2. Literature Review

2.1. Challenges of Transfer Students

Many students achieve their diploma from vocational courses such as Higher National Diploma, Awards for Training and Higher Education and other awarding bodies. They then enroll in Universities to complete graduation. Such students are referred to as either "Vocational" or "Top UP" or "Transition students". However, vocational or Top Up students face numerous obstacles when transitioning to university. Some normally acknowledged obstacles refer to information processing capabilities (White, 2014) and university standards related to acquiring and integrating information as a way in the learning procedure. These aspects affect explicitly on equipping transfer learners and their acceptance to higher-level education work (Eggleston et al., 2001). University teachers need to be active members in this method to aid learners' training in higher standards (Townsend et al., 1993).

2.2. Step-In to HE

"Step-In to HE" (Carter, 2009) is a revolutionary scheme by Aimhigher Greater Manchester and the Greater Manchester Strategic Alliance (GMSA) Lifelong Learning

Network, intended at boosting movement of vocational pupils to advanced level education. The goal of the project is to improve such student's confidence of their capacity to grow using aid of the *"Step-In Module",* a Level IV bridging course of ten credits, corroborated by *"University of Bolton"* and conducted for 7 weeks. The module encompasses research abilities, self-progress managing and practices in academic writing. Students' knowledge had improved appreciably towards the module culmination.

2.3 Generic Bridging Module

According to (Hils, 2006) a *General Bridging Unit* facilitates the transition to Higher Education for pupils moving forward from a Vocational Diploma to the final year of an Honors degree. Based on previous experience about learners continuing from Higher National Diplomas towards the University's honors level study, resources were designed, realized and appraised for such learners. The General Bridging Unit is an assessed module at level two (equivalent to year two of an Honors degree) which pupils learn through the summer before admission to a level three (Final year) honors Programme ('top-up'). The pupils work on this unit by themselves with the aid of an online guidebook. Many courses including such unit, use it as an indicative tool. Learners submit completed tasks in induction week and teachers provide feedback and learners are awarded indicators of achievement. The learners can re-submit their work. This provides the tutor an early sign of which students may require extra help.

The unit applies to many aspects of transition to Higher Education like academic writing

capabilities, radical analysis and research techniques.

Bridging unit is designed to:

• Enhance the basic concepts of a specific subject domain.

• Maximize prospects of academic training through the summer break

2.4. Actions towards improvement of transfer students

The Australian Qualifications Framework (AQF) (Nelson et al., 2014) established the foundation for students with a vocational education and training (VET) qualification to obtain advanced standing when joining a University Programme. Generally recognized challenges pertain to information skills about acquiring and analyze information as process of learning. For instance, the VET curriculum is task wise and performance intensive. In higher education, pupils also must show a deep level of understanding about fundamental concepts of practice and potential analysis capabilities. Numerous learners who ventured into university with VET diploma educations face difficulties with the academic literacy standards, of writing techniques, contemplation, exploration capabilities and harnessing theories to apprise their practice (Watson 2006).

The AQF Council 2013 initiated the groundwork for the smooth institutional progression from vocational education to university. The program comprises of initial intervention by having “orientation week events”, conducted by the university, the library department and individual tutors. The module strategy is especially learner-oriented and involves

information capabilities to inspire academic self-agency and self-learning at university. Provision like *CommonTime* and sessions provide steps to aid learners with varied literacy requirements. *It involves organized learning provision, writing and referencing sessions, bridging modules, and internet-abled tools to augment* **(**Penn-Edwards and Donnison, 2011) *pupil learning and growth*. These have a 'constructive consequence on pupil determination by enhancing learner's academic and community interaction (Harvey *et al*., 2006), their accomplishment is also reliant on *active pupil participation and prominently on involvement.*

2.5. Multiple Formative Assessments and Feedback

A Higher Education Academy report states that several intermediate summative assignments and formative tests (O'Donnell et al., 2016) help learners to supplement their involvement with novel academic practices prior to summative assignments. In an experiment performed by Broadbent et al. (2018), they included aspects of formative practice and adapted them for a large class environment. They created formative assessments that had subtasks which were like subtasks of summative assessment. The multiple formative assessments with feedback of subtasks and iterative summative assessments permitted them to implement formative practices like developing pupils' skills overtime and offering pupils with the prospect of using their feedback to enhance consequent performance. Another research project is the Formative Assessment in Science

and Mathematics Education (FaSMEd) (Wright et al., 2018) that is custom-built with an aim to examine the use of technology to assist *Formative Assessment (FA)* in the classroom. FaSMEd is a collective initiative by group of countries like United Kingdom, The Republic of Ireland, Norway and others. The system provides immediate information to tutors, allowing them to observe pupils' improvement and motivate them towards better knowledge, and enhance their assignments. Learners stated that the technology enabled formative feedbacks guided them to enhance their understanding of concepts and mistakes made and assisted them to improve their work further.

2.6. Interaction with Peers

Prescott and Hellsten (2005) convey the transition of international pupils is difficult due to differences in language, social and educational customs and practices. (Quan et al., 2013) acknowledged further trials for international pupils arriving straight in advanced levels of a UK degree, that such pupils' transitions can be reinforced using interactions with other learners.

2.7. Problem Based Learning

Problem-based learning (PBL) (Kay et al., 2000) is learning through solving a comprehensive, real-life based problem. Critically, PBL dynamically imparts basic problem-solving capabilities.

Problem-solving approaches are significant as they offer means to solve problems by

administering program design knowledge.

These kinds of problems offer a motivation for evolving metacognitive capabilities: Learners manage and track progress on learning and contemplate on how to do tasks more competitively. It involves learners ascertaining the below points:

- problem statement—understanding of aim(s)
- subtasks
- judging their success
- confirming the aspects, they know already
- planning tasks to do and scheduling them
- utilization of three-hour session of class
- utilization of self-guided study hours

PBL results in progress of skills in communication and collaboration. It helps learners to converse their facts and methods and to rationalize conclusions which leads to enhanced learning in the terms of metacognitive abilities.

2.8. SOLO Taxonomy

Structure of the Observed Learning Outcome (SOLO) Taxonomy (Chan et al, 2002) is founded on levels of rising cognitive intricacy. SOLO has lucidity of verb usage for every level. Lucidity of verb level is an influential leverage when tutors are scheduling and writing learning goals using Outcome Based learning and constructive alignment - and when learners are performing their own investigation. SOLO evolves using 5 steps:

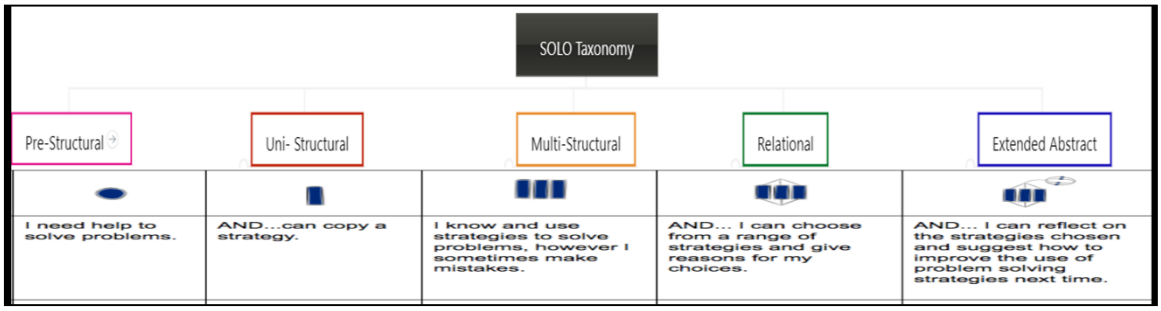


Figure 2: SOLO Taxonomy (Myross Bush School, n.d.)

Table 1: SOLO Taxonomy Levels of Pupil learning method.

Level	Description
Pre-Structural	Pupils are unaware of novel concept.
Uni-structural	The student understands only single area.
Multi-structural	The pupil's answers emphasis is upon many connected terms nonetheless there is not much link among them.
Relational	The different aspects need to be combined into a complete concept. This level intends at understanding a domain thoroughly.
Extended abstract	The earlier learned topic can be now applied on new areas too.

3. Methodology

A plan was created and followed to implement the AR project.

Phase I: Perform Initial Data Collection

Phase II: Plan and implement the activities

Phase III: Data Analysis and Reflections

Phase I: Perform Initial Data Collection

1. Analysis of previous batch student work

   As seen from the previous year's batch, I observed that students find it difficult to cope up with the transition from Level 5 to Level 6 from different awarding bodies like ATHE and HND Pearson towards University Curriculum.

   Most of these students lacked knowledge in Web Development applications and Report Writing Skills. Web development skills are also crucial for their employability aspect.

2. Student Survey

   A Student Survey was carried out for the students who joined Level 6 from HND and ATHE awarding bodies to understand their level of knowledge in those topics. Based on the initial analysis, a plan was created to make the Top Up students work on the current trends of Web Development Technologies using prerequisite subjects [HTML, CSS, PHP] and Report Writing Skills.

Phase II: Plan and implement the activities

1. Lecture Plan and Detailed Lesson Plan was created.
2. *SOLO Taxonomy* was used for to build the knowledge stage by stage (Chan et al, 2002) towards making students Independent learners.
3. Initial *Bridging sessions* were conducted to provide *Uni structural knowledge* **(**Penn-Edwards and Donnison, 2011). (Conducting a practical workshop for Web Development & Referencing Skills)
4. *Problem based learning* (Kay et al., 2000) was incorporated

   Lectures were supplemented with tutorial and practical-lab-sessions. Instruction was provided to students for first hour followed by a two-hour lab session with evaluating students. Scenario-based tasks were planned for students to solve independently on weekly submission basis to track progress.

   Examples of the problems we offer include, creating web form elements, styling the webpages, making webpages interactive, connecting to databases, referencing using books, journals, webpage in Harvard style, performing in-text citation.

   Learners explored their topics and created their solutions. A separate set of problems was set for the advanced class. All required research into techniques described in computer science and academic writing.

5. Online Materials were provided for guidance in the Pre-requisite skills.

6. Multiple *In-Class Assessments & Formative Feedback* was carried out so that I could track the progress of students.
7. A *Discussion Forum* was formed so that learners could submit their questions on Moodle where other classmates can see and answer if they know the concept. It was up for discussion for all classmates to view if they have identical queries. I noticed that "Learning with Peers" (Topping, 2005) provided a good learning environment for students.
8. During Practical sessions, "Pair Programming" was implemented where 1 weak and 1 strong student in programming sat together so that they could discuss points when in doubt.
9. Improving Academic Writing skills

A. Students were briefed about Bolton's E library (Discover @ Bolton), Google Scholar, Citations, Intext Citations.

B. Provided Harvard Referencing Details through LeapOnline weblink

C. Provided task to students to write on "web services" by searching from varied sources like "definition" from Books, "advantages" from Journal and "disadvantages" from website. They were asked to provide intext citation and bibliography for the same. A draft link was created for the learners to check their plagiarism. I evaluated the reports and provided Formative feedback.

Phase III: Analysis and Reflections

1. Upon completion of all the tasks, a comprehensive *analysis* was performed based on their task achievement and knowledge gained.
2. An *exit survey* was conducted to help me understand how much a student has gained confidence in the skills and their progress. It provided a window to help me understand which methods helped them learn better, which were the difficulties they faced. This will aid me in focusing on those aspects for further year teachings.

4. Data Collection and Analysis

Data gathering is the procedure of acquiring and determining information on basic parameters in a conventional system, which promotes one to respond to appropriate queries and appraise conclusions (Lethbridge et al., 2005). To understand the problem at hand a mixed research methodology was followed. Survey is generally used to find detailed aspects of collection of people with common interests (Fraenkel et al., 2011) and to evaluate behavior and perspective of people regarding some problems. To perform qualitative and quantitative analysis, a questionnaire survey method was used as the means for collecting data from the learners to comprehend their experience in learning computing related subjects and academic writing. Summative assessment grades were used for quantitative data analysis. Data was further compiled from In-class assessment and general discussions during class hours.

4.1.Perform Initial Data Collection

A. Student Survey Questionnaire

Table 2: Inferences of Student Survey Questionnaire

Student Survey Question	**Inferences from Student Survey**
Have you completed your Year 1 and Year 2 from Bolton/ ATHE/HND?	45% of the 11 respondants were regular Bolton students. Rest ***55% students were from HND and ATHE awarding Boards*** from other Universities.
Do you already know HTML Programming?	Among 11 responses, ***18 % didn't know HTML*** Programming
Do you already know PHP Programming?	***36 % did not know PHP*** Programming
Do you need extra class to learn HTML?	36% wanted extra class for HTML Programming
Do you need extra class for PHP?	36% wanted extra class for PHP Programming

Specify Reason for extra class required or not required for HTML & PHP	Few stated that they didn't know HTML /PHP while some wanted to refresh the concepts

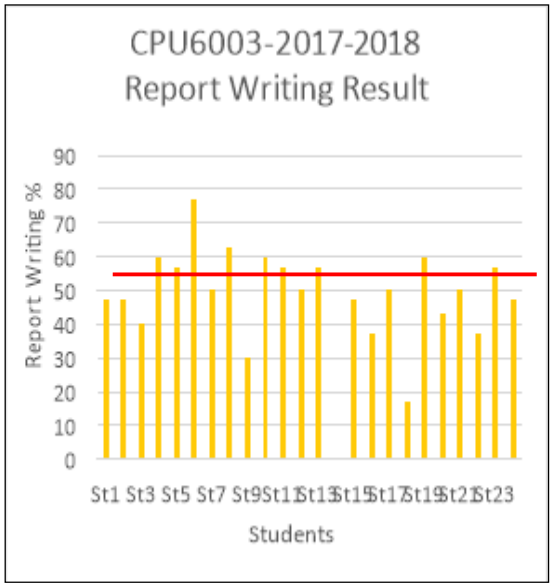
From the above student survey inferences, it was confirmed that the TOP UP students required PHP and HTML programming sessions

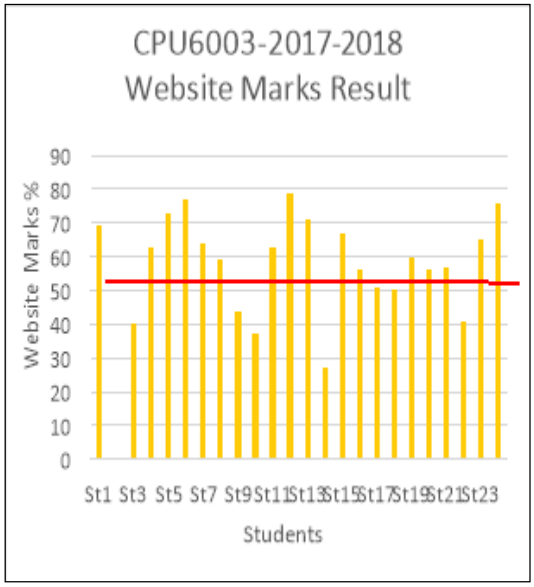
B. Analysis of previous batch student work

Previous year's grades were taken into consideration. Two aspects were assessed in the Summative Coursework based on the criteria provided:

a . Report Writing

b . Web Development Skills





Graph 1: Report Writing Result 2017-18

Graph 2: Website Marks Result 2017-18

83% students obtained below *50%* marks in Report writing.

Website Creation is linked to Employability Skills and from above graph no 2: states that *30%* students are below the *50% benchmark*.

This compelled me to reflect on my practices for improving student's skills of report writing and website creation.

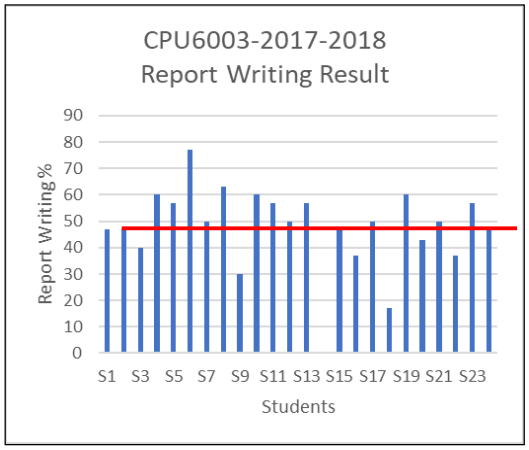
4.2. Implementation of Methodology

The methodology described in **Section 3** was implemented. Further, a comprehensive analysis was planned and implemented.

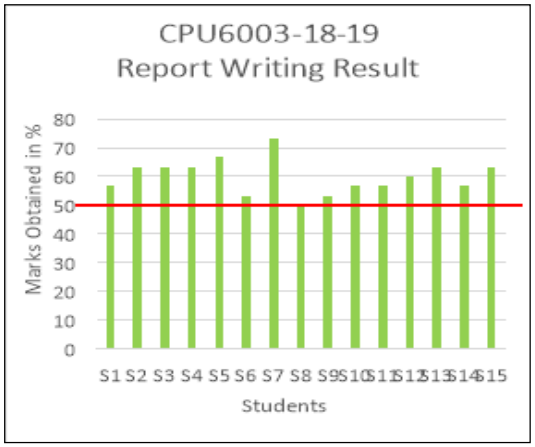
- Analyzing how the student's progress through each week
- Previous year's grades were compared with current year student's grades.

4.3. Analysis of Report Writing Skills of Previous and Current Year

As per methodology, online links to Harvard referencing rules, style were provided on Moodle. An intervention session was conducted by me in class where I asked them to research on the topic and use varied sources like for Definition from Books, Advantages from Journals, and Disadvantages from Website. Accordingly, total of *two formative feedbacks* were provided to students on their draft reports.



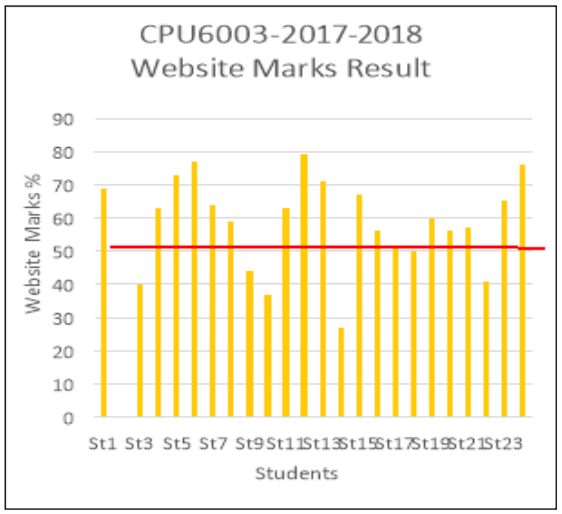
Graph 3: Report Writing Result 17-18



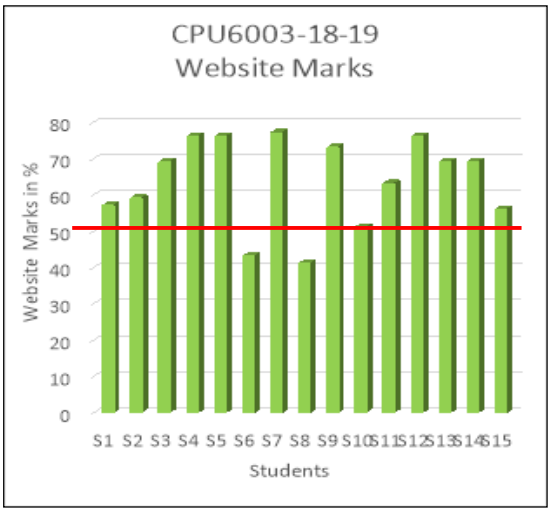
Graph 4: Report Writing Result 18-19

Comparing the previous year batch with current batch results, a wonderful improvement in Report writing skills was observed where only a single student was on 50% mark and 0% were below 50% benchmark. This shows that the intervention class, formative feedback methodology for at least 2 feedbacks was a successful strategy

4.4. Analysis of Web Development Skills of Previous and Current Year



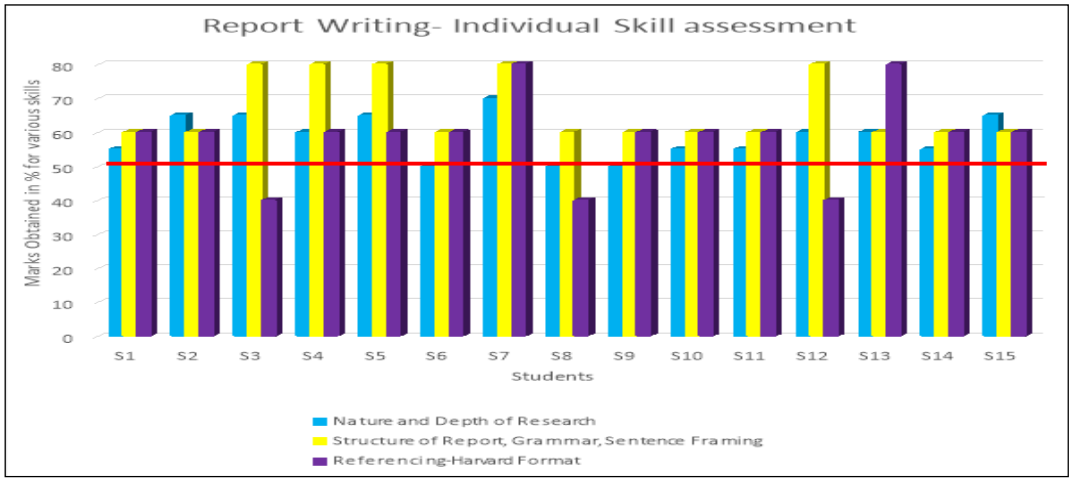
Graph 5: Website Marks 2017-18



Graph 6: Website Marks 2018-19

In Website development, for *previous year(Graph:5)* the benchmark of 50% marks *was not achieved by 30% students.* After the action research project, for *current year(Graph:6)*, the number of students not achieving the benchmark *reduced to only 13%.*

4.5. Analyzing Report Writing- Individual Skill Assessment



Graph 7: Report Writing- Individual Skill Assessment

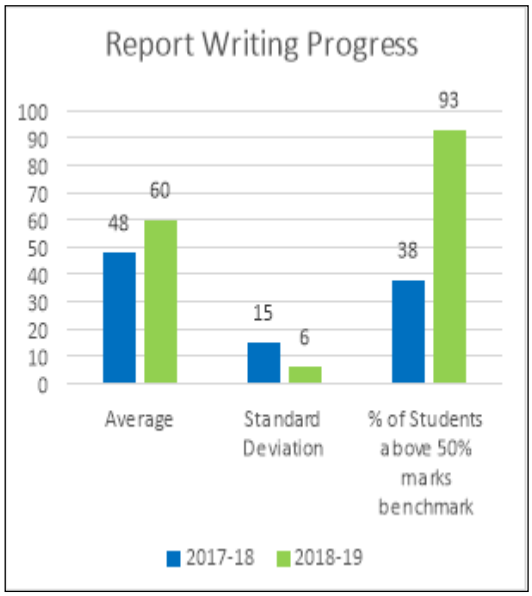
On evaluating each skill(Graph:7), it was observed that, 100% students achieved above 50% marks in skills of Nature and Depth of Research and on their Structure of Report, Grammar and Sentence Framing. 80% students achieved the 50% benchmark for skills of Referencing in Harvard format.

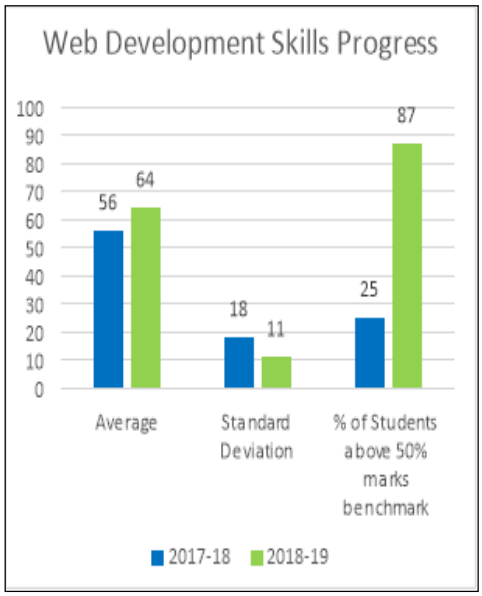
4.6. Comparative Analysis of Summative Assessments of Skills of Previous and Current Year

Table 3: Comparative Analysis of Summative Assessments of Skills of Previous Year 2017-18 and Current Year 2018-19

No.	Comparison Feature	Previous Year 2017-18 (%)	Current Year 2018-19 (%)
A.	**Report Writing**		

1.	**Average**	**48**	**60**
2.	**Standard Deviation**	**15**	**6**
3.	**% of Students above 50% marks benchmark**	**38**	**93**
B.	**Web Development Skills**		
1.	**Average**	**56**	**64**
2.	**Standard Deviation**	**18**	**11**
3.	**% of Students above 50% marks benchmark**	**25**	**87**





Graph 8: ***Report Writing Progress***

Graph 9: Web Development Skills Progress

It was observed that the average marks in % increased for report writing(Graph-8) from the

previous year's 48% to 60% and number of students achieving above 50% marks increased from 38% to 93% and the standard deviation reduced from 15 to 6.

For web development skills, it was seen that(Graph-9) the average marks in % increase from the previous year's 56% to 64% and number of students achieving above 50% marks increased from 25% to 87% and the standard deviation reduced from 18 to 11.

4.7. Exit survey

Exit Survey was based on Survey by (Lahtinen et al., 2005) and modified for current AR Project.

Table 4: Exit Survey Results

1.	Which below methods helped you to learn Programming? You may tick as many you used.	Inferences
A	Programming book	27% felt Programming Book is helpful
B	Lecture notes	45% felt Lecture Notes is helpful
C	**Practical Sessions**	**90% felt Practical Sessions were helpful**
D	Sample programs	63% felt Sample Programs was

		helpful
E	Interactive visualizations/ Videos	45% felt Videos is helpful
F	Discussion Forums	18% felt Discussion Forums is helpful
G	**While working with classmate**	**72% felt working with classmate (Pair Programming) is helpful**
2. Identify your skill level in Harvard Referencing in Bibliography		64% felt they are at Intermediate level. 18% felt they have Basic Knowledge and Beginner level
3. Identify your skill level in In-text Citation		72% felt they are at Intermediate level of Harvard Referencing in Intext Citation. 9% felt they have Beginner level
4. Identify your skill level in Problem solving		54% felt they are at Intermediate level of Problem Solving. 36% felt they have Basic Knowledge and Beginner level

5. Identify your skill level in HTML Programming	HTML, 55% felt they are at Intermediate level, 36% at Expert and 9% at Beginner level.
6. Identify your skill level in PHP Programming	PHP, 63% felt they are at Intermediate level, 9% at Expert and 21% at Beginner and Basic level.
7. Identify your skill level in CSS Programming	64% stated they were at Intermediate level
8. Identify your skill level in Database Programming	Database Programming, 36% felt they are at Intermediate level, 36% at Expert and 27% at Basic level.
9. Identify your skill level in Error Handling Techniques	Error Handling Techniques, 55% felt they are at Intermediate level, 18% at Beginner and 27% at Basic level.

Students felt that working with classmate (Pair Programming) and practical session was the best way to learn *programming skills* and stated that the *sample programs* provided were a effective guideline to learning. Maximum students felt they had improved in their knowledge and practice of Harvard referencing in Bibliography and In-Text citation and their web development capabilitites. But they wanted more practice with problem solving, error handling techniques and database programming.

4.8. Tutor Feedback by Students

Table 5: Tutor Feedback by Students

10.	Formative Feedback provided by Tutor was useful	82% strongly agreed and 18% agreed that Formative Feedback was useful
11.	What aspects of this course were most useful or valuable?	interconnectivity between different databases as well as handling client requests All Sample program and practical sessions PHP programming Practical sessions Learning different programming languages and implementing it in practical application developments.

	Presentation slides, sample documents and lectures

From above table for Tutor evaluation by students, it was seen that "Formative Feedback proved helpful for learners" and, they were interested in having extra practical sessions for furthering their knowledge. They agreed that Tutor was helpful and always available as I used to answer their queries by emails or even Whatsapp if required.

Validity and Reliability of Questionnaire

Cronbach's alpha (Rezaei and Lovorn, 2010) is a common measure of internal consistency ("reliability") of the developed questionnaire (Hinojosa-Pareja et al., 2020). A questionnaire was developed (Jonsson and Svingby, 2007). that intended to determine "students' skill improvement ". The questionnaire consisted of 9 questions. A total of n=12 participants completed the questionnaire. Each question was measured using a 4-point Likert item from "Basic knowledge" to "Expert". In order to understand whether the questions in this questionnaire were internally consistent (Ragupathi and Lee, 2020), a Cronbach's alpha was run using **Minitab 19 software**. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.9276.

Correlation Matrix

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Q2	0.464							
Q3	0.801	0.458						
Q4	0.415	0.497	0.263					
Q5	0.711	0.670	0.504	0.690				
Q6	0.732	0.464	0.777	0.330	0.607			
Q7	0.656	0.616	0.700	0.551	0.606	0.715		
Q8	0.695	0.561	0.692	0.549	0.612	0.710	0.924	
Q9	0.765	0.393	0.646	0.542	0.824	0.456	0.452	0.545

Cell Contents
Pearson correlation

Figure 3: Correlation Matrix

Item and Total Statistics

Variable	Total Count	Mean	StDev
Q1	12	2.917	0.793
Q2	12	3.083	0.515
Q3	12	2.833	0.835
Q4	12	3.250	0.622
Q5	12	2.583	0.900
Q6	12	2.667	0.888
Q7	12	2.833	1.193
Q8	12	2.250	0.866
Q9	12	2.500	0.674
Total	12	24.917	5.946

Figure 4: Statistics

Omitted Item Statistics

Omitted Variable	Adj. Total Mean	Adj. Total StDev	Item-Adj. Total Corr	Squared Multiple Corr	Cronbach's Alpha
Q1	22.000	5.274	0.8260	0.7963	0.9138
Q2	21.833	5.606	0.6351	0.8292	0.9268
Q3	22.083	5.282	0.7662	0.9603	0.9173
Q4	21.667	5.565	0.5782	0.5977	0.9282
Q5	22.333	5.211	0.7880	0.9759	0.9158
Q6	22.250	5.242	0.7620	0.9323	0.9176
Q7	22.083	4.926	0.8222	0.9458	0.9177
Q8	22.667	5.193	0.8490	0.9287	0.9117
Q9	22.417	5.452	0.7049	0.9733	0.9217

Figure 5: Cronbach's Alpha for Each Question

5. **Discussion**

Many TOP UP students were introduced to web development skills and academic writing skills first time. Based on previous batch experience, their results and the current batch discussion in class, a need was felt to carry out this action research project. Hence a student survey was performed to understand how many students required a *bridging session* for web development skills and intervention for both the academic and programming skill. In year 2017-18, 24 student results were taken into consideration. In the current action

research project 15 student results were considered. The project was performed successfully by planning for the activities in the AR project methodology and implementing them.

Based on the analysis, it was seen that *problem-based learning, multiple feedback* and an on-going support through learning with peer using discussion forum bridged the gap between the TOP UP students and regular students in terms of these skills. A brilliant improvement in Report writing skills was that all students had surpassed 50%-mark benchmark proving the intervention class, formative feedback methodology (at least 2 feedbacks) was a successful strategy. In Website development, after the AR-project, students achieving the 50%-mark benchmark rose from 25% to 87%. This proves that changing the process of teaching and learning by inclusion of *bridging session, problem-based learning, peer programming and learning through peers* was productive. An improvement was observed in the students who initially felt they had no prior knowledge of the prerequisite skills.

7. Conclusion

The undertaken action research project was an enlightening exposure of teaching and learning. It guided us to know how curriculum model can be selected and adapted related to inculcating and improving report writing and web development skills in TOP UP students joining from various other vocational qualifications. Implementing problem-based

learning proved productive in web designing skills. Learner feedback highlighted the upgrading in their confidence in Web technology and Report Writing skills. It was observed that the amalgamation of *curriculum model, SOLO taxonomy, problem-based learning and multiple formative assessment and feedback* helped TOP UP learners to come in par with the regular students.

We realized that *practical sessions and working with classmates (pair programming)* help students to discuss, implement and verify better than working individually. From exit survey, it was observed that many students felt their skill level was in primary phases in database programming, error handling and problem solving. Our future research would be in exploring methods and techniques to alter our strategy to improve on these skills too. About 100% students confirmed the *formative feedbacks* guided them in refining their assessment tasks before the final submission.

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