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Research Article

Undergraduate Students' Industrial Work Experience in Pharmacy Education: A Revelation for the Future

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Abstract:

Background: The Students Industrial Work Experience Scheme (SIWES) is a training program aimed at preparing higher education students for future industrial careers.

Method: A cross-sectional study was conducted on computer and pharmacy students at Enugu State University of Science and Technology, utilizing a self-administered questionnaire. Data were cleaned and coded in Microsoft Excel and analyzed using SPSS (IBM Corp) version 27, employing descriptive statistics for variable description and inferential statistics to assess relationships between categorical variables, with a significance level of $p \leq 0.05$.

Results: In the study, out of the 205 questionnaires distributed, 198 questionnaires were retrieved. One hundred and six (106) participants are female and ninety-two (92) males. Most (87.9%) believed that SIWES effectively exposes students to real-world job situations. Furthermore, 77.8% strongly agreed that the curriculum offers substantial learning opportunities. Notably, 40% of computer science students reported a positive view of the SIWES program, compared to only 6% of pharmacy students ($\chi 2(1) = 6.147$; $p=0.046$). Similarly, 72.5% of computer science students viewed the curriculum favorably, compared to just 6% of pharmacy students ($\chi 2(1) = 8.217$; $p=0.016$).

Conclusion: The students had a good knowledge of the aim of SIWES and a positive attitude toward the SIWES program.

Key Words: knowledge; attitude; perceptions; computer science students; pharmacy students; industrial training (IT) program, SIWES

Introduction

The Students' Industrial Work Experience Scheme (SIWES), or industrial training, is a crucial period during which students gain practical experience with a company during a semester break [1]. This hands-on training equips students with essential skills, industry knowledge, and work ethics, allowing them to apply their university learning in real-world settings. It is a vital component of higher education curricula, enabling undergraduates to acquire work experience and expertise while completing their studies [2]. This experience enhances communication, managerial skills, confidence, and career prospects across various disciplines [1,2]. Additionally, it is important to refocus course curricula on practical knowledge and effective execution. Establishing training facilities near or within universities is essential, as many students prefer training locations close to residential areas [3].

Hands-on work experience is a longstanding tradition, originating from the apprenticeship system of the Middle Ages [4]. However, its purpose has evolved from skills training for professional practice to preparing work-ready graduates across disciplines at the institutional level [5,6], in which students gain insight into how theory applies in practice through industrial training, which is highly valued by employers seeking graduates with practical experience. Consequently, most academic institutions now integrate industrial training into their curricula, acknowledging its significance [6,7]. This training not only prepares students professionally but also enhances their self-confidence and fosters a commitment to lifelong learning [7,8]. Many alumni of educational

administration programs regard industrial training as the most valuable aspect of their education [9].

Invariably, the Students Industrial Work Experience Scheme (SIWES) is a human capital development initiative in Nigeria that provides pharmacy students with practical training in real-world pharmacy settings [10]. This program allows them to apply theoretical knowledge to patient care, drug dispensing, and other pharmacy operations, effectively bridging the gap between classroom learning and professional practice [11,12]. It is a vital part of their education, preparing them for the workforce after graduation. However, students sometimes encounter a disparity between their academic knowledge and industry requirements, along with insufficient feedback and evaluation of their performance, which can hinder the learning experience [11]. Likewise, a study among engineering students revealed the necessity of well-structured industrial training to develop professional skills and relevant experience for their future careers [13]. Such training instills confidence in organizations when hiring future employees and requires considerable focus from students, institutions, and industries [13]. These programs significantly enhance graduates' chances of securing employment in a competitive job market [14]. However, a review of the literature reveals a lack of studies focused on pharmacy students. This study aims to compare the knowledge, attitudes, and perceptions of pharmacy students and computer science students regarding the SIWES program at Enugu State University of Science and Technology.

Methods

Study Design

The study a cross-sectional study conducted between April 2024 and August 2024 in the Enugu State University of Science and Technology, Enugu State, Nigeria. A questionnaire was used as a research tool to compare the knowledge, attitude and perception of pharmacy students and computer science students towards industrial training. Computer science students were randomly selected for this comparison because computer science program has been the oldest department in the university and have conducted numerous successful SIWES programmers for their students.

Study Setting

The study was conducted at Enugu State University of Science and Technology, on establishment, the University which was conceived on a Presidential model after Harvard University made impressive landmarks and stamped its name as the first University of Technology and first State University in Nigeria with her main campus at Agbani, Enugu State University of Science and Technology, is located at Agbani in Enugu State, Nigeria and its vision and mission are vigorously pursued.

Sampling and Sample Size

According to the SIWES coordinator for both pharmaceutical sciences and computer sciences, at the time of conducting this study there were 72 students in 500 level of the of the faculty of pharmaceutical sciences and 190 students in 400 level students of the department of computer science of Enugu State University of Science and Technology. These levels of students were selected for the study because most of the students must have undergone and completed the mandatory industrial training program. The sample size was determined using Taro Yamani's statistical formula, the number of students in pharmaceutical sciences and computer science, assuming a confidence level of 95% with a confidence interval of +/-12 in each case, a sample size of while sample size was 190 (61 and 129 from pharmaceutical sciences and Computer science respectively) were deemed fit for the study. An addition of 10% of the calculated sample size (190) was added to accommodate non-usable questionnaire due to improper filling (making a total of 205 i.e., 64 Faculty of pharmaceutical sciences students and 194, computer science students).

Simple random sampling technique was used to select students that made up the sample for the study. The sampling technique is preferred to ensure a greater degree of representation and decreasing the probability of sampling error in the sample.

Eligibility Criteria

Students who were eligible for inclusion in the study were either in 4th year computer science or 5th year in pharmaceutical science within the study period 2023/2024 academic session and were required to have been actively studying at the Enugu State University of Science and Technology. Students willingly provided informed consent to participate in the study. Students in other levels of computer science or pharmaceutical sciences were excluded. Also, students from other level asides student from other faculties and departments were excluded and those that refused consent were excluded from the study.

Study Instrument

A 19-item questionnaire was adapted questionnaire from a 2020 study by Balkhi, B in 2020(17), modified to fit the research focus. The initial draft was face-validated by four academic staff overseeing the SIWES program in pharmacy and computer science. The questionnaire consists of two parts: Section i, gathers respondents' biodata (level, gender, and department), while Section ii, features five items divided into three sub-sections assessing students' knowledge, attitude, and perception of SIWES. The instrument employs a 5-point Likert scale: Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D), and Strongly Disagree (SD). A pilot survey with 10 respondents from the Department of Applied Microbiology and Brewing yielded a Cronbach alpha of 0.8

Data Collection

The instrument was administered directly to the respondents with the help of two research assistants. The research assistants were trained in a one-day interaction during which the researcher got them acquainted with the purpose of the study and explained to them how to administer and collect the instrument. Survey instruments were disseminated on a face-to-face basis to all students selected for the study from selected departments. Responses were promptly recorded at the location of interaction, and respondents were not permitted to retain the questionnaires for subsequent reference.

Statistical Analysis

The data was cleaned with Microsoft Excel and analyzed using Statistical Package for the Social Science version 27. Descriptive statistics such as frequencies and percentages were used to summarize all the variables. Inferential statistics such as chi-square test were used to determine the association between categorical variables. The significance level was set at $p \leq 0.05$.

Results

Socio-demographic characteristics of Respondents (N=198)

This shows a nearly equal gender distribution, most of the participants are female 106 (53%) compared to males 92 (46%). Most of the students, 102 (51.5%) fall within the 18-25 years age group, followed by those aged 25-30years, 73 (37%), while a smaller portion is above 30 years old 22 (11%), and only 1 (0.5%) are below 18. Other details are shown in Table 1.

Variables	Frequency (n)	Percentage (%)
Gender		
Female	106	53
Male	92	46
Age (years)		
<18	1	0.5
18 -25	102	51.5
25 – 30	73	37
>30	22	11
Department		
Computer science	135	68
Pharmaceutical sciences	63	32
Religion		
Christianity	184	93
Islam	2	1
Traditional	12	6

Table 1: Socio-demographic characteristics of Respondents (N=198)

Knowledge of Industrial Training

This section reveals the level of the respondents' knowledge of the Industrial Training (IT) program (Table 2). A majority, 73.2%, felt their academic background adequately supported their participation in the program. However, most students considered the pre-program orientation insufficient. Half of the respondents believed the IT program met its objectives, though many remained undecided or disagreed. Perceptions about the difference between classroom concepts and industry practices varied, with most respondents not perceiving a disparity, while a notable portion did. Importantly, 76.8% acknowledged that they gained knowledge during the IT program. In all, less than half (45.5%) of the participants had good knowledge. A significant portion of the respondents (39.9%) fell into the moderate knowledge category. Lastly, 14.6% of the respondents were categorized as having poor knowledge (Table 3).

Statement	SD	D	U	A	SA	Mean ± SD
Was there quality academic background to carry out industrial training program?	13 (6.6)	15 (7.6)	25 (12.6)	56 (28.3)	89 (44.9)	3.97±1.215
Was there enough orientation before the industrial training program?	62 (31.3)	43 (21.7)	16 (8.1)	51 (25.8)	26 (13.1)	2.68±1.469
Were the expected objectives achieved at the end of the training program?	17 (8.6)	21 (10.6)	51 (25.8)	55 (27.8)	54 (27.3)	3.55±1.236
Are the concepts used in the classroom different from those in the industry?	70 (35.4)	22 (11.1)	16 (8.1)	43 (21.7)	47 (23.7)	2.87±1.640
Was there knowledge gained during the industrial training?	-	2 (1.0)	5 (2.5)	39 (19.7)	152(76.8)	4.72±0.560

Table 2: Knowledge of Respondents

SD=Strongly Disagree D=Disagree U=Undecided A=Agree SA=Strongly Agree

Classification	Frequency (n)	Percentage (%)
Good knowledge	90	45.5
Moderate knowledge	79	39.9
Poor Knowledge	29	14.6
Total	198	100

Table 3: Classification of Respondents knowledge (N=198)

Attitude towards industrial training

A significant majority (87.9%) strongly agreed that IT is crucial for exposing students to real work-life situations, with only 0.5% strongly disagreeing and 2.0% undecided. When asked if IT is a waste of time, 61.1% strongly disagreed, and 16.2% disagreed, further supporting the positive view of IT. However, 12.1% remained undecided, while 10.6% agreed or strongly agreed with the negative perspective. Regarding whether IT fosters self-motivation, 66.2% strongly agreed and 28.8% agreed, with only 0.5% strongly disagreeing. Opinions on the importance of the IT scheme varied: 30.3% agreed and 24.7% strongly agreed, while 27.3% were undecided, and 17.7% disagreed or strongly disagreed. Lastly, perspectives on whether IT promotes good occupational judgment were mixed, with 26.3% strongly agreeing, 25.8% agreeing, 35.4% undecided, and 12.7% disagreeing (Table 4). Nearly half of the respondents (45.5%) had a positive attitude toward the IT program, while 38.9% showed a negative attitude, and 15.7% expressed a moderate attitude (Table 5)

Statement	SD	D	U	A	SA	Mean± SD
Industrial training is an important strategy to expose students to real work life situations	1 (0.5)	-	4 (2.0)	19 (9.6)	174 (87.9)	4.84±0.484
Industrial training a waste of time	121 (61.1)	32 (16.2)	24 (12.1)	9 (4.5)	12 (6.1)	1.78±1.191
Industrial training encourages self-motivation to carry out tasks	1 (0.5)	-	9 (4.5)	57 (28.8)	131 (66.2)	4.60±0.627
Students take the scheme as an important task	20 (10.1)	15 (7.6)	54 (27.3)	60(30.3)	49 (24.7)	3.52±1.229

Industrial training helps in exercising good occupational judgment at all times	15 (7.6)	10 (5.1)	70 (35.4)	51(25.8)	52(26.3)	3.58±1.154

Table 4: Attitude towards industrial training program (N=198)

	Frequency (n)	Percentage (%)
Positive Attitude	90	45.5
Moderate Attitude	31	15.7
Negative Attitude	77	38.9
Total	198	100

Table 5: Respondents' attitude classification

Perception towards Industrial training

Most respondents had a positive view of the integration of theory into practical applications, with 48.5% strongly agreeing and 39.9% agreeing that the program effectively connected theoretical knowledge with real-world experience. Furthermore, many participants valued the social interactions fostered by the IT program, with 56.1% strongly agreeing and 36.9% agreeing. The program was also recognized for providing significant learning opportunities, as indicated by the strong agreement of 77.8% of respondents (Table 6). In all, majority of respondents (55.1%) perceived the IT program positively, indicating favorable views on its effectiveness and benefits. Conversely, 31.3% expressed negative perceptions, reflecting some dissatisfaction, while 13.6% held neutral views, indicating ambivalence. This distribution shows that although most participants viewed the program positively, a significant minority had critical opinions, highlighting diverse perspectives on its impact and effectiveness (Table 7)

Statement	SD	D	U	A	SA	Mean ±SD
Was there sufficient training to meet expectations?	26 (13.1)	44 (22.2)	35 (17.7)	39 (19.7)	54 (27.3)	3.26±1.407
It to integrate theories into real-life application?	3 (1.5)	3 (1.5)	17 (8.6)	79 (39.9)	96 (48.5)	4.32±0.816
Were there challenges and stimulating tasks during the training period?	10 (5.1)	16 (8.1)	32 (16.2)	65 (32.8)	75 (37.9)	3.90±1.147
Was there social experience with colleagues from other schools?	3 (1.5)	3 (1.5)	8 (4.0)	73 (36.9)	111 (56.1)	4.44±0.777
Does industrial training provide learning opportunities?	1 (0.5)	2 (1.0)	3 (1.5)	38 (19.2)	154 (77.8)	4.73±0.593

Table 6: Perception towards Industrial training (N=198)

Classification	Frequency (n)	Percentage (%)
Positive perception	109	55.1
Neutral perception	27	13.6
Negative perception	62	31.3
Total	198	100.0

Table 7: Classification of Respondents' perception (N=198)

Relationship between respondents' socio-demographics and knowledge about IT program

A higher percentage of female students (51, or 53.8%) demonstrated good knowledge of the industrial training program compared to male students (39, or 43.3%) ($\chi2(1) = 0.762$; $p = 0.683$). Additionally, students aged 18-25 years showed greater knowledge of the IT program, with 50 (55.6%) possessing good knowledge compared to those in other age groups ($\chi2(3) = 5.231$; $p = 0.514$). Overall, no significant association was found between gender, age, and knowledge of the IT program (Table 8).

Variables	Good Knowledge	Moderate Knowledge	Poor Knowledge	χ^2 (df)	*p*-value
Gender				0.762 (1)	0.683
Female	51 (53.8%)	41 (51.9%)	14 (48.3%)		
Male	39 (43.3%)	38 (48.1%)	15 (51.7%)		
Age (years)				5.231 (3)	0.514
<18	1 (1.1%)	0 (0.0%)	0 (0.0%)		
18 -25	50 (55.6%)	39 (49.4%)	13 (44.8%)		
26-30	29 (32.2%)	30 (38.0%)	14 (48.3%)		
> 30	10 (11.1%)	10 (12.7%)	2 (6.9%)		
Department				4.018 (1)	0.134
Computer science	64 (71.1%)	48 (60.8%)	23 (79.3%)		
Pharmaceutical sciences	26 (28.9%)	31 (39.2%)	6 (20.7%)		
Religion				1.687 (2)	0.793
Christianity	85 (94.4%)	73 (92.4%)	26 (89.7%)		
Islam	1 (1.1%)	1 (1.3%)	0 (0.0%)		
Traditionalist	4 (4.4%)	5 (6.3%)	3 (10.3%)		

Table 8: Association between respondents' socio-demographic characteristics and Knowledge (N=198)

Relation between respondents' socio-demographics and attitude towards IT program

A higher percentage of female students (53 or 59.6%) exhibited a positive attitude towards the industrial training program compared to male students (37 or 40.4%) ($\chi2(1) = 1.909$; $p = 0.385$). Similarly, more computer science students (54 or 60.0%) had a positive attitude towards the IT program than pharmacy students (36 or 40.0%) ($\chi2(1) = 6.147$; $p = 0.046$). Overall, the department was significantly associated with the respondents' attitudes towards the IT program (Table 9)

Variables	Positive Attitude	Neutral Attitude	Negative Attitude	χ^2 (df)	p-value
Gender				1.909 (1)	0.385
Female	53 (59.6%)	15 (48.4%)	38 (49.4%)		
Male	37 (40.4%)	16 (51.6%)	39 (50.6%)		
Age (years)				5.903 (3)	0.437
<18	1 (1.1%)	0 (0.0%)	0 (0.0%)		
18 -25	48 (53.3%)	18 (58.1%)	36 (46.8%)		
26 – 30	25 (27.8%)	9 (29.0%)	39 (50.6%)		
>30	16 (17.8%)	4 (12.9%)	2 (2.6%)		
Department				6.147 (1)	**0.046**
Computer science	54 (60.0%)	21 (67.7%)	60 (77.9%)		
Pharmaceutical sciences	36 (40.0%)	10 (32.3%)	17 (22.1%)		
Religion				3.800 (2)	0.434
Christianity	81 (90.0%)	31 (100.0%)	72 (93.5%)		
Islam	1 (1.1%)	0 (0.0%)	1 (1.3%)		
Traditionalist	8 (8.9%)	0 (0.0%)	4 (5.2%)		

Table 9: Association between respondents' socio-demographic characteristics and Attitudes (N=198)

Association between respondents' socio-demographic characteristics and perception

Students aged 18-25 had a more positive perception of the IT program (n=56, 51.4%) compared to other age groups ($\chi2(3) = 6.198$; $p = 0.398$). Additionally, a higher percentage of Computer Science students (n=54, 60%) had a positive attitude towards the IT program than Pharmacy students (n=79, 72.5%; $\chi2(1) = 8.217$; $p = 0.016$). Overall, there was a significant association between the department and respondents' perceptions of the IT program (Table 10).

Variables	Positive Perception	Neutral Perception	Negative Perception	χ^2 (df)	p-value
Gender				1.281 (1)	0.527
Female	58 (53.2%)	17 (63.0%)	31 (50%)		
Male	51 (46.8%)	10 (37.0%)	31 (50%)		
Age (years)				6.198 (3)	0.398
<18	0 (0.0%)	0 (0.0%)	1 (1.6%)		
18 -25	56 (51.4%)	14 (51.9%)	32 (51.6%)		
26 – 30	46 (42.2%)	8 (29.6%)	19 (30.6%)		
>30	7 (6.4%)	5 (18.5%)	10 (16.1%)		
Department				8.217 (1)	**0.016**
Computer science	79 (72.5%)	22 (81.5%)	34 (54.8%)		
Pharmaceutical sciences	30 (27.5%)	5 (18.5%)	28 (45.2%)		
Religion				1.972 (2)	0.741
Christianity	100 (91.7%)	26 (96.3%)	58 (93.5%)		
Islam	2 (1.8%)	0 (0.0%)	0 (0.0%)		
Traditionalist	7 (6.4%)	1 (3.7%)	4 (6.5%)		

Table 10: Association between respondents' socio-demographic characteristics and perception (N=198)

Discussion

In this study, 198 students completed the survey, primarily fourth- and fifth-year computer science and pharmacy students, comprising 68% and 32% respectively. Most respondents were aged 18-25 years (51.5%). A significant number strongly agreed that they had a solid academic foundation for industrial training. While many felt that the objectives of the SIWES program were met, however, most disagreed regarding the adequacy of orientation before the program. A review noted concerns about the SIWES program's effectiveness in bridging the gap between theory and practice [18]. Overall, respondents demonstrated a good knowledge of SIWES; notably, female students displayed better knowledge than their male counterparts, and those aged 18-25years showed greater knowledge compared to other age groups.

On the assessment of attitude, most respondents believe that IT is essential for exposing students to real work situations and fosters self-motivation in task completion. Overall, there was a positive attitude towards the program, with female students expressing more positivity about the SIWES program than male students. Additionally, computer science students had a more favorable attitude than pharmacy students. The respondents' attitudes towards the IT program were also significantly influenced by their department. This aligns with a study, which found that the SIWES positively impacted accounting education students' attitudes towards the accounting profession [19].

This study also revealed that most students strongly agree that industrial training integrates theory with real-life applications and offers opportunities to enhance what they learned in school. They also felt it aids their professional development, echoing the findings on Covenant University students' perceptions of the SIWES program, which they viewed as relevant to their studies, introducing them to new work methods and fostering personal growth [20][15]. Overall, the majority had a positive perception of the program, particularly those aged 18-25, and computer science students were more favorable than those in pharmacy. A significant statistical relationship exists between students' perceptions and their respective departments.

Conclusion

This study showed that students have good knowledge towards SIWES program. Likewise, they have a positive attitude towards IT program and, the respondents have a positive perception towards IT program. This study is one of the few that compares pharmacy and computer science students' knowledge, attitudes, and perceptions of the SIWES program, hence is recommended that more studies be carried out to assess the impact of the SIWES program on the pharmacy student in Nigeria.

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