ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 10, Issue 1, January 2023

Performance of Students in Computer Programming: An Analysis

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Abstract*— The recent challenges in the delivery of instruction leads to the indispensable use of online platforms. Tasks of mentors and learners are now required to be done online. Presently it is undeniable that all disciplines involve the use of a computer. Thus the increasing utilization of computers is not only for computer education and computer programming skills but in all fields or disciplines. This study determined the challenges and experiences encountered by lecturers and students in relation to the acquisition and transfer of relevant knowledge in computer education specifically in programming courses. The Random Sampling method was used in identifying the sample size that is calculated based on the following parameters: (1) population size; (2) margin of error; and (3) confidence level. The total population of respondents is one hundred twenty-nine (129), eighty-four (84), or 65% males and forty-five (45), or 35% females. The test-retest method was employed to ensure the reliability of the instrument and the Modified-adopted survey questionnaire for gathering the required data. In order to check the coefficient of reliability of the data the Spearman-Brown method was utilized. Results revealed that most males prefer to enroll in Bachelor of Science in Computer Science (BSCS), keener and more motivated to do programming. They are keener in computer programming. Study also shows that students need to have the good foundation in courses like (1) knowledge in basic science and math course as well as (2) more hands-on programming activities. In order to produce well-versed BS Computer Science graduates, it is recommended that a more enhanced IT and Computing Education and Orientation Program should be given priority.

***Keywords*—Computer Programming, Computer Science, Data, Simulation, IT.**

I. INTRODUCTION

Students of SDSSU-Main Campus enrolled in the Program Bachelor of Science in Computer Science often experience difficulties grasping basic programming concepts, particularly in programming courses. One reason is that many of the students came from secondary schools without any previous programming knowledge or experience. More often the problem lies in setting program goals that lead to difficulty especially those with poor programming skills. The paper examines related work relative to difficulties of students as novice learners of programming. It will also identify interventions particularly on the introductory programming course in order to increase success rate in the succeeding programming courses. The BSCS Students are the main interest of the study.

Framework of the Study

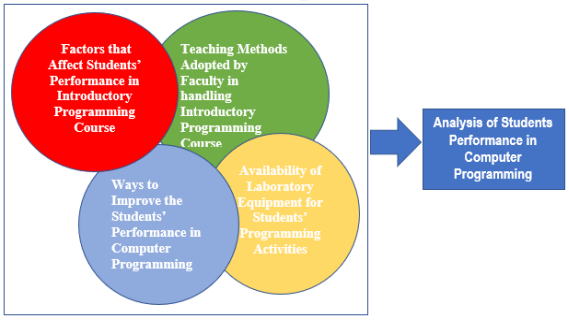

Figure 1. "Analysis of Students Performance"

Research Objectives

The study aims to know the following:

1. Contributory factors that affect students' performance in introductory programming courses;
2. Teaching methods adopted by faculty in handling introductory programming courses;
3. Availability of laboratory equipment for students' programming activities;
4. Ways to improve the students' performance in programming.

II. MATERIALS AND METHODS

Research Design

The study aims to analyze the performance of students in computer programming introductory courses about students' experience and learning approaches. Descriptive survey research design is used as the most appropriate tool to undertake this research. Shami & Hussain (2008) defines research as "a type of study used to portray present-day condition, settings, and events". The study adopted the survey method by administering a survey questionnaire in order to consider the view of a group of people or respondents who are considered to represent the entire population or group.

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Population

A total of one hundred twenty-nine (129) respondents made up of eighty-four (84) males and forty-five (45) females or 65% and 35% of the total population respectively across 2nd year to fourth-year levels of BSCS students in SDSSU-Tandag Campus.

Data Sources

A group of students enrolled in BS Computer Science who have finished their introductory programming course is the respondents of the study. Random sampling was employed to determine the sample size and allow all members of the population to have equal chances of being selected for the sample. It is calculated based on the following parameters: (1) population size; (2) preferred margin of error; and (3) desired confidence level.

Queries on the background of the students were made which included their gender, age, year level, previous educational background, and description of the final grade in programming 1, each respondent was asked about their contentment with the chosen field to ascertain students' performance in an introductory programming course.

Instrumentation and Collection of Data

The instrument used in gathering required data is a modified-adopted survey questionnaire composed of 23 items distributed in 4 subparts namely: 1) contributory factors affecting students' performance; 2) teaching methods adopted by lecturers; 3) laboratory equipment's availability and usability; 4) ways of improving students' performances. The five (5) points Likert scale was employed on the questionnaire to obtain relevant information from the respondents

The questionnaire was randomly administered to 129 student respondents. The five (5) point Likert scale corresponds to values ranging from 1 to 5 as follows: a) Strongly Agree (SA)= 5 points; b) Agree (A)= 4 points; c) Undecided (UD)= 3 points; d) Disagree (D) = 2 point and; e) Strongly Disagree (SD)= 1 point.

Validation and Reliability of the Instrument for Data Collection

Prior to administering to the target respondents, the instrument was subjected to content validation through proof-reading, review of items for purposes of clarity, appropriateness of language, expressions, and instructions to respondents. The test-retest method was used to test the reliability of the instrument and sees to it that the measurements obtained in one sitting are both representative and stable over time. On the other hand, the Spearman-Brown method was employed to check the coefficient of reliability of the data or test scores taken, the reliability of test scores would increase or decrease if the number of observations or items in a measurement instrument has increased or decreased.

Data Analysis

The mean statistic was used for data analysis. The computation of the mean value of the responses to each item of the questionnaire signifies that an item with a mean from 3.5 and above is accepted and lower than 3.5 is rejected.

TABLE 1. STATISTICAL RANGE AND DESCRIPTION OR INTERPRETATION OF RESULT FROM RESPONDENTS

Statistical Range	Statistical Description
1 - 1.80	Strongly Disagree
1.81 - 2.60	Disagree
2.61 - 3.40	Undecided
3:41 - 4:20	Agree
4:21 - 5.00	Strongly Agree

III. RESULTS AND FINDINGS

Statistical Analysis System (SAS) is the software system for further data analysis of the answered questionnaire from the responses made. Table 1 and Table 2 show the Distribution of Respondents and the Summary of Students' Background Information respectively.

From Table 2 below, the outcome of the respondents regarding their gender, age, and year level implies that a greater percentage of the respondents were males (65% as against 35%) meaning males are more engaged in Computer or IT than females. Most of them are between the ages of 20 to 24 and only a few of them between the ages of 15 to 19 years old. A greater percentage of the respondents are in their second-year level (75%) and the remaining percentage 25% is distributed among third-year and fourth-year students.

TABLE 2. Distribution of Respondents

Number of Respondents		Age			Year Level		
Female	*Male*	*15-19*	*20-24*	*25 and Up*	*2nd Year*	*3rd Year*	*4th Year*
45	84	12	96	21	97	22	10

Concerning Table 3 below, it presents the responses based on the students' educational background before tertiary education and the description of his/her final grade in programming 1 as well as determining whether he/she is contented in the BSCS curricular program chosen. The responses indicate that majority of the respondents are graduates from government-owned secondary institutions and eighty percent (80%) of them have good grades in Introductory Programming who at the same time said that they are contented in their chosen field. As shown in the result from Table 1 and 2, the age and gender is not a critical factor to students' performance in computer programming

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

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but their secondary education is realized to be generally influencing their performance.

TABLE 3. Summary of Students' Background Information

Previous Educational Background		Description of Final Grade in Programming 1			Contentment in the Chosen Field	
Comprehensive School	*Upper Secondary School*	*Fair*	*Good*	*Excellent*	*Yes*	*No*
87	42	14	103	12	111	18

IV. DISCUSSION

Examining the outcome in Table 4, it is understood that the following factors influence students' performance in the course Programming 1 namely: knowledge in basic science and math course; technicality in programming; not enough hands-on activities; lack of functional units to be used for hands-on and the time allowed for actual programming is not adequate to perform the given tasks. Although thirty-two percent (32%) of the respondents were undecided whether some of the students admitted into the program have no interest., yet the data explicates that student access can be a contributory factor since the number of those who agree is closest to the number of those who are undecided. Hence, all indicators enumerated contribute to the computer programming performance of BSCS students, most are in the second-year level.

TABLE 4. Result on the Contributory Factors to Students' Performance in Introductory Programming Course

Statement No.	Indicator/Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Weighted Mean	Remarks
1.	Basic science and math background is not enough	6	66	50	1	6	3.54	Agreed
2.	Admitted into program without interest.	9	52	41	2	24	3.33	Undecided
3.	Programming is too technical	12	83	30	0	4	3.80	Agreed
4.	Insufficient hands-on activities	14	69	35	0	11	3.67	Agreed
5.	Lack of functional equipment.	20	58	39	0	12	3.67	Agreed
6.	Time allotted for laboratory is not sufficient	13	68	36	0	11	3.65	Agreed
7.	Lack of internet facility	20	64	67	0	8	3.60	Agreed
Grand Mean = 3.61								

Table 5 presents the analysis responses based on learning procedures of faculty in Programming 1. As to the order of three (3) teaching methods identified, results obtained shows that the demonstration and simulation method is the most utilized approach. This is because 72% of the respondents recognize that the abovementioned teaching/learning approach is commonly applied by the faculty members in charge of the course, followed by lecture method then the conduct of makeup classes when needed. Results in Table 5 indicated that the demonstration/simulation method is more relevant for instruction programming courses and more time should be allotted for it, lesser time for lecture and conduct of makeup classes can be utilized for hands-on activity. This is to make teaching and learning more productive. It can be concluded that the lack of teaching methodologies adds to the discontentment of students attending the course.

TABLE 5. Teaching/Learning Approach Adopted

Statement No.	Indicator/Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Weighted Mean	Remarks
1.	Lecturers adopted lecture method for programming course	17	88	23	0	1	3.94	Agreed
2.	Demonstration and simulation method used	14	93	21	0	1	3.93	Agreed
3.	Conduct of makeup classes during vacant schedules when needed	14	81	29	0	5	3.81	Agreed
Grand Mean = 3.89								

It is described in Table 6 that the subsequent necessary equipment and personnel are available in the Internet and Computer Laboratories of SDSSU-Tandag Campus namely: 1) functional computer units; 2) needed software; 3) trained computer technicians and laboratory attendants; 4) internet facility and; 5) accessibility of updated instructional materials which makes the programming activity easier and of major importance to achieve the goal of computer programming. It should be noted that the abovementioned equipment and staff are vital in the said course because if these are not available chances are, there might be potential students in the class or the program in general but lack of hands-on activity may hinder their capability to explore and perform more than what they learned from their mentor.

Nevertheless, even though there are available computer technicians and laboratory attendants still forty-three percent (43%) of the respondents were undecided whether the laboratories are poorly maintained by the said personnel and the result also reveals that fifty-three percent (53%) of the respondents were undecided if there is a standby generator intended for computer and internet laboratories that can be used during a power cut.

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TABLE 6. Availability of laboratory Equipment and Personnel

Statement No.	Indicator/Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Weighted Mean	Remarks
1.	Functional Computer Systems	20	81	17	0	1	4.01	Agreed
2.	Availability of needed Softwares	22	86	20	0	1	4.00	Agreed
3.	Trained Computer Technicians and laboratory attendants	24	81	23	1	0	3.98	Agreed
4.	Poorly Maintained Laboratory	6	47	55	2	18	3.29	Undecided
5.	Standby Generator	10	44	68	0	7	3.44	Agreed
6.	There is internet facility	24	74	22	0	3	3.97	Agreed
7.	Updated Instructional Materials are accessible	19	82	26	0	2	3.91	Agreed
Grand Mean = 3.80								

Among those enumerated means to improve students' performance, the three most recommended ways are: 1) Adoption of demonstration/simulation method; 2) A well-equipped laboratory, and; 3) Admission in the BSCS program based on merit and interest. As shown in the table, it can be concluded that the ones recommended playing a vital role in enhancing the programming ability of the learners at the same boosting their interest or motivate them to perform the best that they can do.

Moreover, the availability of updated Instructional Materials and training of laboratory staff should not be disregarded nor be considered less important considering the constant and hasty transition in computing, in which delivery of updated information by skilled and knowledgeable faculty and staff is a must.

TABLE 7. Ways to Improve Students' Performance

Statement No.	Indicator/Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Weighted Mean	Remarks
1.	Admission based on merit and interest	15	83	29	0	2	3.86	Agreed
2.	Demonstration /simulation method be adopted	20	95	12	0	2	4.03	Agreed
3.	Laboratory be well equipped	29	92	16	0	1	4.08	Agreed
4.	Increase staffing and training of staff	36	62	30	0	1	4.03	Agreed
5.	Instructional material be made available	29	79	18	1	1	4.05	Agreed
Grand Mean = 4.01								

V. CONCLUSION AND RECOMMENDATIONS

Derived from the findings of the research. Males who are more involved in doing computer or IT-related hands-on activities are more likely to enroll in BS Computer Science. As a result, they score higher and are more positive about computer programming than females, making them more involved and motivated in programming and IT-related competitions. Since there is already a K-12 Curriculum in effect, the majority of the respondents are between the ages of 20 and 24, and only a handful are between the ages of 15 and 19, since these students are already in Senior High School.

Moreover, there is no relation between a student's computer programming success and the type of secondary school from which he or she graduated. In other words, both government and private-sector institutions will produce high-quality, well-informed students. This claim is based on Table 2, which indicates that the majority of respondents are graduates from government-owned secondary schools who are happy in their chosen field and have good grades in programming 1 (introduction to computer programming. The result of the study also concludes that basics or foundation courses like (1) knowledge in basic science and math courses; (2) more hands-on activities focusing more on programming technicalities than lecture are the ones expected by learners from their mentors.

It can also be concluded that demonstration and simulation methods are one of the most effective teaching techniques or methods used by faculty members teaching programming courses. As a result, the learning methods used in a programming course are more important in terms of student success. In most cases, practical and collaborative learning approaches are much more effective, persuading the learner to think outside the box and solve the problem. However, the above-stated strategies or teaching methodologies can be successfully achieved if the following are constantly and carefully considered 1) functional computer units; 2) needed software; 3) trained computer technicians and laboratory attendants; 4) internet facility and; 5) accessibility of updated instructional materials.

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