Tracing Mathematics and Science Education Graduate from a State University Between 2011 to 2015: Implications for Rural Education

Joy A. Bellen[1]
Visayas State University
Baybay City, Philippines
[1] joy.bellen@vsu.edu.ph

Article Information

Abstract: Tracer study provides feedback on graduates' competencies and characteristics of curriculum relevant to their current status. This study aimed to trace the mathematics and science education graduates of the Visayas State University from 2011-2015 with a response rate of 65%. Using descriptive survey, results showed that graduates are predominantly females, in early twenties and LET passers. A great number of them were employed immediately after graduation by application, recommendation and linkage with friends. Adequate competencies specific to the area of specialization, critical thinking and teaching process skills, demand of specialization in the locality and school's reputation were considered for immediate job acquisition. The graduates' level of satisfaction with the University's services, learning environment and facilities were generally very relevant. The existing undergraduate curricular programs were very adequate and very relevant. The College of Education should trace non-passers to provide insights on the contributory factors as policy input.

I. INTRODUCTION

Graduate tracer study (GTS) is a mechanism to evaluate curricular programs. When regularly conducted, GTS is a useful tool to monitor and review the curricular offerings (e.g., Abela, Cuadra, & Sapan, 2015; Aquino et al., 2015; Belecina & Ocampo, 2017; Cagasan, Dargantes, Florentino, & Lasquites, 2017, Cañizares, 2015; Gines, A. C. 2014), accommodate recent labor market demands (e.g., Austero, Armenia, & Serino, 2012; Janer et al., 2015; Panit, Bentor, & Ongy, 2013; Rojas & Rojas, 2016; San Jose, 2014) and address workforce inequities (Halili et al., 2017). Additionally, the use of GTS can determine the capability of higher educational institutions, i.e., Visayas State University (VSU), in preparing graduates to meet the demands of the workplace (Cañizares, 2015). During quality assurance monitoring, results from the GTS is one of the indicators of Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP) accreditation. Although, the accreditation in the Philippines is voluntary, it is, however, seen as a "process to ensure that the

institution has reached a certain level of quality" (Conchada & Tiongco, 2015; De Lara, 2017).

GTS provides essential information to strengthen the Mathematics and Science education in the College of Education of VSU in the preparation for the AACCUP and ultimately to review the curricular offering. Further, in response to current reforms in the education sector - K to 12 program - aimed to overhaul the landscape of Philippine education, teacher education institutions (e.g., VSU) are mandated to produce competent teachers who can affect positive student outcomes. We have a study published elsewhere (Bellen, Abela & Truya, 2018) that focuses on the institution's licensure performance and this GTS is a continuing effort to better understand the TEI's performance. On related note, GTS focus on science education graduates can provide a robust picture of mathematics and science education in VSU to keep in check with the standards (Conchada & Tiongco, 2015). Moreover, it can add more evidence on the VSU's vision as a premier university in science and technology in the Visayas (VSU, 2011).

Scholars highlight the importance of GTS in HEI. Schomburg (2003) asserts that "graduate surveys are most popular for the analysis of the relationship between higher education and work

because it allows to combine five major approaches: (a) a look on labor market issues, i.e. quantitative-structural data on employment and career; (b) more in-depth view on the character of work and related competencies; (c) a direct evaluation of study conditions and provisions bases on the experiences of the graduates; (d) an understanding of the values and orientations of the graduates, and finally; (e) the collection of information on retrospective views on higher education". Self-evaluation techniques like tracer studies can offer a thorough and impartial evaluation of the courses (Evangelista & Morales, 2017).

Moreover, legislations require monitoring the educational outcomes. The Philippine Qualifications Framework (PQF) was established in response to criticisms of the persistent mismatch between educational requirements and industry needs in the Philippines, the country's fragmented qualifications system, the impending reality of an ASEAN economic community, and issues with comparability for a sizable number of skilled workers and professionals working abroad. (E.O. 83, 2002, & as cited by Mustacisa, 2016). The Commission issued outcome-based and typology-based quality assurance (CHED, 2014), in which one of the foci is to encourage institutional assessment (Evangelista & Morales, 2017).

As a tool, GTS is seen as one possible way to find out essential feedback (Cañizares, 2015) and adequacy and relevance of the course offerings (Evangelista & Morales, 2017) such as science education in VSU. Similar studies have been conducted in other settings, e.g., Cañizares (2015) but to understand more on VSU's context, this study was conducted.

This study aimed to trace VSU's math and science education graduates for the school year 2011-2015. Specifically, the study sought answers to the following questions:

a)   What is the profile of the graduates in terms of personal characteristics, employment and transition to employment?

b)   What are the graduates' personal perception in terms of the relevance of VSU's curricular programs (General Education courses, Professional Education courses, Major Field courses, Field Study and Student Teaching Experience), participation in co/extra-curricular activities, involvement in community extension services (CES) and their guidance and students services experience)?

c)   What is the degree of adequacy and relevance of the university's science education curricular program?

II. METHODOLOGY

Research Design

This tracer study used descriptive research design. It was used to describe the experiences of the graduates during their undergraduate studies. It helped the graduates convey their personal observations regarding the relevance and adequacy of their academic preparations in the teacher education institution.

Research Samples

The study traced mathematics (BSEd-Mathematics) and science education graduates (BSEd – Biological Sciences and BSEd – Physical Sciences) for the school year 2011-2015. A census was used to collect the desired information from every member of the mathematics and science population (Draugalis & Plaza, 2009). A response rate of 65% was obtained. Draugalis and Plaza (2009) believed that a response rate of greater than 60% was optimal to minimize nonresponse bias.

Data Collection Method

The revised standard tracer study instrument designed by the University collected data from the participants on the following aspects: 1) students' general information; 2) educational background; 3) training(s) or advance studies attended after college; 4) employment data; and 5) retrospective evaluation of the program (Belecina & Ocampo, 2017). The survey questionnaire was patterned after the CHED format. Some parts of the instrument were modified to suit to the present study.

The respondents were informed on the purpose and invited to participate in the study. The researcher administered some of the questionnaires personally, others were sent through email and social networking sites.

Data Analysis

The data collected were classified, tabulated and coded for analysis. Frequency count, percentage, weighted mean and rank were the statistical tools. The scale for adequacy and relevance was interpreted as shown in Table 1 from Gines (2014):

Table 1

Scale of adequacy and relevance

Scale	Adequacy	Relevance
1.00-1.50	Not Adequate	Not Relevant
1.51-2.50	Somewhat adequate	Somewhat Relevant
2.51-3.50	Adequate	Relevant
3.51-4.50	Very Adequate	Very Relevant
4.51-5.00	Extremely Adequate	Extremely Relevant

Ethical Consideration

The author declares no conflict of interest.

III. RESULTS AND DISCUSSION

Demographic profile

The total population of mathematics and science education majors was 169. The response rate was 65% (110 responded the survey). Thirty-seven were males and 73 were females. Respondents' age distribution ranged 20-40; most (54.55%) of the respondents were age 20-24 at the time of survey. One hundred eight respondents indicated they passed the LET while two did not indicate. Shown Table 1 the estimated gross family income; most of them were low-income families. Forty percent of the respondents have scholarships; 23.64% were academic scholars funded by the University, 16.37% (LGU – 9.09%, CHED – 2.75%, DOST - 4.55%) were funded by different government agencies. The remaining 1.82% were scholars of private agencies.

Professional Characteristics of the Graduates

It can be observed that the LET performance of both math and science majors within the five years period did not significantly increase. The respondents took the LET right after graduation, i.e., scheduled during August or September in the year they graduated.

It was observed that the score in the LET exam was above the passing percentage of 75%. The highest score is 87%. Less than 10 percent of them had rating within 85-89 which indicated a slim chance of producing topnotchers of the LET.

One of the contributing factors to the successful licensure is intensive review. Sixty-two (56%) respondents enrolled in a review center, 46 (42%) did not enroll and two (2%) did not indicate whether they took review classes. Of those who took the review classes, 41 passed

Table 1

Demographic profile of the respondents

Characteristics		Frequency	Percentage
Age	20 – 24	60	54.55
Distribution	25 - 29	48	43.64
	30 and up	2	1.82
	TOTAL	**110**	**100**
Estimated family income	1 - Below P 10,000.00	19	17.27
	2 - P 10,000.00 to less than P 20,000.00	28	25.45
	3 - P 20,000.00 to less than P 30,000.00	43	39.09
	4 - P 30,000.00 to less than P 40,000.00	10	9.09
	5 - P 40,000.00 to less than P 50,000.00	5	4.55
	6 - P 50,000.00 to less than P 60,000.00	2	1.82
	7 - P 60,000.00 to less than P 70,000.00	1	.91
	8 - P 70,000.00 and above	2	1.82
	TOTAL	**110**	**100**
Scholarship Availed	Academic scholar	26	23.64
	LGU	10	9.09
	CHED	3	2.73
	DOST	5	4.55
	Private	2	1.82

the mock board exam, 20 did not pass while one respondent did not indicate.

The respondents also indicated that they are pursing advanced studies. Almost one-half (40%) pursued graduate studies, almost one-third pursued trainings (in-service [20.91%] and tech-voc [7.27]) and almost one-third (31.82) did not indicate. The reasons for pursuing graduate studies were varied. The reasons were professional development (40%), promotion (27.27%) and peer pressure (0.91%).

Employment Characteristics of the Respondents

Interestingly, as shown in Table 2 almost all of the respondents (96.36%) were employed; 82.73% were full time regular/permanent, 5.45% were regular nonpermanent, 6.36% were working just part-time which may be interpreted as underemployed and 3.64% were not employed. The reasons for not being employed were: 1) taking advance or further study, 2) attending to family concern, 3) personal decision job to take a

break and 4) currently looking for new opportunities after resigned from previous job.

Results showed that Mathematics and science major graduates from 2011 to 2015 had full-time jobs at the time of the study. Most of the respondents were teaching in public secondary schools (82.73) (Aquino et al., 2015; Panit, Bentor, & Ongy, 2013) and only one was on working in a call center.

The respondents were asked on how they find their first job. The result was varied; the primary means was through application (31.82%). The same was observed in Rojas and Rojas (2016). Some reported that they were recommended by someone (23.64), responded to an advertisement (15.45%), linkage with friends (14.55%) and the rest were through placement officer in the school, PESO and scholarship availed.

The majority of respondents (77.27%) were employed right away after graduating, and the majority of those jobs (82.93%) were relevant to their field. Most of the respondents have gross

Appendix 2

Employment data of the respondents.

Characteristics		Frequency	Percentage
Are you presently employed?	Yes	106	96.36
	No	4	3.64
	TOTAL	**110**	**100**
Employment status	Part-time	7	6.36
	Full time nonpermanent	6	5.45
	Full time regular/permanent	91	82.73
	Not employed	4	3.64
	Did not indicate	2	1.82
	TOTAL	**110**	**100**
Nature of current work	Teaching	104	94.55
	Freelance/homebased job	1	0.91
	Call center agent	1	0.91
	Not employed	4	3.64
	TOTAL	**110**	**100**
Type of institution employed with	Private-secondary	3	2.73
	Private college/university	0	0.00
	Public-secondary	91	82.73
	Public college/university	10	9.09
	Did not indicate	10	9.09
	TOTAL	**110**	**100**

monthly saving of P15,000 to 25,000 which is an entry level salary in the public schools.

Table 3 revealed that the top three competencies useful in the job were content specialization knowledge, critical thinking and teaching process skills. These self-reported competencies were relevant to BSED because they are primarily trained in their specialization. The results, which are similar to those of Canizares (2015), demonstrate that the teacher-educators of the VSU greatly improved its graduates in terms of these crucial traits for becoming successful mathematics and science teachers.

Table 3

Competencies that the respondents have found useful in the job

Competencies useful in the job*	f	%	Rank
Content specialization knowledge	92	83.64	1
Critical thinking skills	85	77.27	2
Teaching process skills	83	75.45	3
Oral communication skills	78	70.91	4
Professional education knowledge	75	68.18	5.5
Understanding of the learning process	75	68.18	5.5
Literacy skills	74	67.27	8
IT skills for teaching	74	67.27	8
General education knowledge	74	67.27	8
Written communication skills	70	63.64	10.5
Problem-solving skills	70	63.64	10.5
Field study and practicum knowledge	68	61.82	12
Reflective thinking	63	57.27	13
Numeracy skills	58	52.73	14.5
Systematic planning and organization	58	52.73	14.5

Multiple responses possible

However, reflective thinking, numeracy skills, and systematic planning and organization were the least useful competencies in their job. This result is similar to the previous findings that

graduates have acquired the competencies designed in the curricular program to holistically develop competent teachers deemed useful and relevant to their jobs (Aquino et al., 2015; Belecina & Ocampo, 2017; Cagasan et al., 2017; Cañizares, 2015; Evangelista & Morales; 2017; Gines,2014; San Jose, 2014).

Retrospective evaluation of the curricular program

Retrospective evaluation provides the glimpse whether the graduates are provided with or lacking the important attributes as teachers based on their preparation in their degree program (Belecina & Ocampo, 2017; Cañizares, 2015; Evangelista & Morales, 2017; Gines, 2014; Janer et al., 2015). The respondents reported that their experiences with practice teaching mentors were focused on assessing the students' performance, teaching the subject matter and reflecting on the teaching practice. While their experience with practice teaching supervisor was focused on the instructional methods, teaching the subject matter, and aligning with the basic education curriculum and writing lesson plan. The respondents believed that both practice teaching mentor and supervisor worked the least in terms of how the practice teacher should interact with the parents (Cañizares, 2015). The pre-service teachers met the parents few times in a semester. In the secondary level, teachers and parents usually meet at the end of each quarter during portfolio day.

Retrospective evaluations of graduates provided crucial information about the relevance of the curricula and student services at the VSU. Results have shown a very relevant curricular program (M=4.30, SD=.86). Particularly, they had rated the knowledge of subject matter well enough (M=4.63, SD=.70), which is interpreted as "extremely relevant". However, participation in extension (M=4.05, SD=1.07) and research (M=3.94, SD=1.07) were rated the lowest among the 10 criteria, with their responses being somewhat dispersed. In student services was rated very relevant (M=4.30, SD=.86). Particularly, they had rated the library services (M=4.65, SD=.77), and college dean's office services (M=4.55, SD=.82) well enough which is interpreted as "extremely relevant". On the other hand, health services (M=3.85, SD=.89) which is interpreted as "very relevant" were rated the lowest among the six criteria. The finding

corroborates with previous studies in which the graduates have recognized the role of the University's services for their professional growth (Belecina and Ocampo, 2017; Evangelista & Morales, 2017; Gines, 2014).

Studies have demonstrated retrospective study on the adequacy and relevance of science education (e.g., Cañizares, 2015; Evangelista & Morales, 2017). Researchers contend that a retrospective analysis of the curriculum program offers information on how to improve it and connect its offerings and other areas with the required requirements to achieve better results that might provide the nation a competitive advantage abroad. In this study, results showed that adequacy of curricular offering was excellent (M=4.35, SD=.84). Top three statements were; 1) possesses positive values and attitudes in science education (M=4.58, SD=.79), develop strong pedagogical content knowledge as it relates to teaching science (M=4.49, SD=.79) and 3) demonstrate analytical and critical thinking grounded on sound principles of science as a discipline (M=4.43, SD=.83). On the other hand, the least three statements were; 1) develop deepened awareness in current research and theories about science learning and teaching (M=4.22, SD=.90), 2) demonstrate understanding of research results and research methods appropriate for the development of studies that will contribute to new theoretical insights and practical approaches to science education (M=4.21, SD=.92), and 3) develop research-based models that are useful in planning instruction and assessment in science/math (M=4.19, SD=.90).
The relevance of curricular offering was excellent (M=4.45, SD=.82). Top three statements were: 1) possesses positive values and attitudes in science education (M=4.61, SD=.71), 2) possesses updated content in science and in latest instructional strategies and competencies (M=4.54, SD=.71), and 3) demonstrates expertise in planning, implementing, and evaluating training programs in science education (M=4.52, SD=.79). However, the least three statements were: 1) apply theoretical knowledge and results in a

practical setting as science instruction, evaluation, and assessment, curricular development, and technology development (M=4.37 SD=.90), 2) display a comprehension of research findings and methodologies adequate for the formulation of studies that will lead to new theoretical understandings and useful strategies for scientific teaching (M=4.37, SD=.91). and 3) develop research-based models that are useful in planning instruction and assessment in science/math (M=4.35, SD=.91).

The retrospective study showed the adequacy and relevance of math and science education. Points of improvement were presented. Research skills are noticeable. Recently, teacher-researcher is a buzzword in teacher education. At the time of study, action research was not yet required in the curriculum. In-service teachers have reported a difficulty in doing action research (Cortes et al., 2021). One plausible reason is the lack of integration of research skills in the undergraduate levels. In order to advanced action research in teacher community, a study has shown that praxis and a facilitating situation that relies on experience-based communication help teachers learn how to do action research (Ponte, 2002).

IV. CONCLUSION

As envisioned in CHED policy guidelines, VSU's mathematics and science education is responsive. Most of the respondents are feamales in their early 20s who have passed the LET. Through applications, recommendations, and connections with friends, several of them found jobs right away after graduation. The study revealed that, on top of area of specialization along with the reputation of the University, the respondents' adequate competencies specific to the area of specialization, critical thinking and teaching process skills were major factors to immediate job acquisition. Additionally, the respondents' perceptions of the university's facilities, services, and learning environment were typically extremely important. The current undergraduate courses have been considered to be very adequate and very relevant to the graduates.

At the time of the study, CoEd has not yet produced a topnotcher, and most rating in the

LET were below 85%, an intervention can be made, e.g., promotional advocacy activity similar to attract promising students to go into mathematics and science teaching should be a regular activity of the college to enhance the pool of creative students (Cañizares, 2015). With the transition to the new curriculum, i.e., K–12 compliant, graduates should have the skills and knowledge required to confidently teach K–12 students. It is noteworthy that only passers responded to the survey; therefore, tracing the non-passers should be addressed to provide information on the contributing variables as policy input. Lastly, tracer studies incorporating stakeholders like employers can provide relevant feedback to the program.

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