

Bachelor of Software Engineering: A Case Study for an Effective Degree Programme

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Abstract:

How can the application of open, online and flexible education provide employability at the highest professional level? This is made possible with the Bachelor of Software Engineering (BSE) Degree programme offered at The Open University of Sri Lanka applying appropriate technology and innovative approaches meeting the demand in software industry. In this paper, we discuss the effectiveness of the programme according to the graduate employability and employer satisfaction. The degree programme was initiated due to enormous demand from the industry for IT specialists. Accordingly, the main objective of the programme was set as producing quality graduates to meet the software industry requirements. The curriculum was designed considering IEEE/ACM guidelines matching any benchmark. As the industry partnership and collaboration are important in curriculum/syllabi design and providing industry placements, an MOU was signed with Sri Lanka Association of Software and Services Companies. The effectiveness of the degree programme has been qualitatively analysed from the responses of the graduates of the BSE programme. Seven batches of students have been enrolled to date, 53 have graduated and 130 are currently following the programme. Our survey indicates higher employability of the graduates in the software industry while others work in IT related occupations or are entrepreneurs. Employers are highly satisfied with the graduates. We believe that, the commencement of this degree programme has been a timely venture when open and flexible learning is becoming very popular in the world today. These graduates will contribute actively and constructively towards future challenging endeavours that would have a significant impact in the development of Sri Lanka.

Introduction

The Open University of Sri Lanka (OUSL) introduced a new degree programme – Bachelor of Software Engineering (BSE) in 2009 to meet the demand for IT specialists in the country. There were various requests from the IT industry as well as from the government to the universities to produce more IT graduates. It was evident as predicted in (Keaton & Hamilton, 1996) that more than 400,000 system analysts would be required in US and it would be one of the fastest growing occupations for the next 10 years – 1996 to 2005. Similarly, supply of software engineers will be less than the required and the gap will widen through 2012 (Geer, 2006). Likewise, authors predicted the high growth in the IT industry in the Asia-Pacific Rim countries as well (Geer, 2006; Keaton & Hamilton, 1996).

In the same way the demand for IT specialists in Sri Lanka were high as in the global trend. In 2007, the Sri Lanka ICT Association (ICTA) projected that there would be 20% growth of IT workforce each year (Sri Lanka ICT Association, 2007). Accordingly, it showed that the number of IT graduates produced by universities would be very much less than the required number. Therefore, in order to sustain the IT industry it was suggested finding solid solutions for this problem. Considering these facts, OUSL decided to commence a new degree programme that caters highest demanding job categories such as Programming/Software Engineering (28%) and Testing & Quality Assurance (21%) and Project & Programme Management (5%) as stated in (Sri Lanka ICT Association, 2007). According to the same report, jobs in Programming/ Software Engineering had the highest salary at the entry level.

Specialization of the new degree programme was selected in line with the IEEE/ACM guidelines given for computing curricular (The Joint Task Force for Computing Curricula 2005, 2005). Computing is recognized as one of the largest subject areas in higher education today. However, under the umbrella of ‘Computing’ there are five streams identified: Computer Engineering, Software Engineering, Information Systems, Information Technology and Computer Science. Since software engineering stream covers the areas of most demanding job categories in the

IT industry, it was decided that the new degree programme should be in the specialization of software engineering. Consequently, the new degree programmed was named Bachelor of Software Engineering. Introducing the BSE degree has become a timely venture as Sri Lanka is ranked to be in Top 20 outsourcing destinations in the world (*The shifting geography of innovation*, 2009).

The degree, BSE was designed and developed by the Department of Electrical and Computer Engineering of OUSL in partnership with Sri Lanka Association of Software and Services Companies (SLASSCOM). The process of designing the BSE degree was started in 2007 and the degree was offered for the first time in 2009. Eventually, it has become the first Software Engineering Degree programme offered in Sri Lanka.

Designing of the curriculum was a challenge as the field of computing continue to expand. Recognizing the rate of change in the discipline the curriculum was designed to educate an undergraduate for long-term success rather than immediate employment. However catering for industry needs for a certain extent is necessary for graduates to gain employment. Therefore more attention was given for following aspects: actual requirements of the stakeholders, major capabilities that the IT industry was expecting from graduates, major problems faced by fresh graduates, feasibility and sustainability of offering the degree (Udugama & Liyanagama, 2011). The curriculum was designed based on IEEE/ACM guidelines for Software Engineering (The Joint Task Force on Computing Curricula, 2004), with extensive help from the industry as described in (Udugama & Liyanagama, 2011). Further, during the course development professionals from the industry were appointed to the course teams. Moreover industry oriented courses were developed by course teams appointed from SLAASCOM member companies. On the other hand, during the delivery the support given by SLAASCOM is commendable. The courses that are more industry oriented and some of the specialized Software Engineering courses are conducted by them. Further, an MOU was signed between the OUSL and SLASSCOM to facilitate industrial placement for undergraduates.

When delivering any course in ODL mode, maintaining student engagement is the critical factor for being successful. This programme consists of blended on-line courses with minimum face-to-face activities such as day schools and laboratory classes. Take home activities such as mini projects and assignments also contribute as an important component of learning as well as a component of formative assessment. Final year group project and industrial training placement are compulsory components that were designed to fulfil the graduate attributes such as ability to do team work, independent learning, and gain the transferable skills by familiarizing with actual work environment.

The main objective of the BSE is to produce well-qualified software engineering graduates for the IT industry. In order to achieve this objective the department has put maximum effort at every stage: design of the curriculum, development of the courses and delivery of the courses. After enrolment of seven batches and graduation of over 50 students it is high time for critically evaluate the degree programme for its effectiveness. Accordingly, a survey was conducted among the graduates and their employers to identify the effectiveness of BSE degree programme. The results and conclusions arrived from the survey are presented in this paper.

Effectiveness of a degree

It is evident that the effectiveness of a degree programme cannot be measured in simple terms. According to the literature, effectiveness is described as to what extent the planned activities are realised and planned results are achieved. (Carmichael, 2002) claims that effectiveness can be expressed by applying some qualitative criteria. (Massy, 2012) says

“.... to establish efficiency and effectiveness metrics, I would observe that measures such as degrees relative to the needs of the labor force certainly reflect effectiveness...”

Though the most common measurement would be employability, objective of a degree programme should be educating a student for a long-term success (Fincher & Finlay, 2015). However, some of the employers require graduates to start working immediately in projects without further training. Therefore, objectives of certain degree programmes are designed targeting employability within a short period.

On the other hand, employability is defined differently in numerous sources. However all these definitions have common aspects such as ability to get employment; skills, attributes, ability and chances; finding, maintaining or sustaining abilities; and being relevant to environment - economic, social and community, marketplace (Pillutla & Narayana, 2014).

The report on 'Employers' Perceptions on the Employability Skills of New Graduates' (Lowden, Hall, Elliot, & Jon Lewin, 2011) presents a comprehensive study including many case studies done in order to ascertain what the key attributes employers are looking for in new graduates. The case study reveals many best practices of UK Higher Education Institutes that make sure graduates are suitable for employment soon after graduation. These attributes include problem solving skills, management skills and soft skills in addition to technical knowledge and skills. According to (Butler, Whitehead, & Winkleman, 2001), 'group interaction skills' have been identified as very important in the Employer Satisfaction Survey. These 'group interaction skills' include teamwork, leadership, problem solving, conflict resolution and ability to adapt to change.

In order to improve the effectiveness universities put different efforts to achieve high employability. According to (Kulkarni, Abhyankar, Kulkarni, & Kulkarni, 2015), *Teaching-Learning process* has to be strengthened by imparting adequate technical knowledge in the curriculum. Further, (Pillutla & Narayana, 2014) affirm the idea to impart both knowledge and competency in the education itself. According to their argument, graduates will find employment easily as employers are looking for competence that derives out of knowledge. In (Bass, McDermott, & Lalchandani, 2015) a new approach is proposed called *global software engineering*, where students work in a virtual team of a project. This will give hands on experience in global software engineering, which includes geographical distance, temporal distance and socio-cultural distance. Similarly, in the BSE degree more focus is given for the industrial training. Furthermore, final year project is designed as a real industrial project built in with teamwork and project management.

Nevertheless outcome of different approaches have mixed results. In most of the cases, there are positive effects (Bass et al., 2015; Kulkarni et al., 2015; Pillutla & Narayana, 2014). However, according to the report on Computing Graduate Employability (Fincher & Finlay, 2015), computing graduates have the highest unemployment rates in UK. Moreover offering a software engineering degree effectively in ODL is even more challenging as the university has to take a greater effort to give the transferable skills to the graduate.

Methodology

The focus of this research is to analyse the effectiveness of the BSE degree programme and the factors that led to the effectiveness. In order to identify the effectiveness of the BSE degree, it was decided to consider employability of the BSE graduates, as the main objective of the programme is to produce specialists for the IT industry. In most of the published literature, it is indicated as an appropriate measure for effectiveness. Since the goal is to produce specialists for the industry, getting feedback from the employers is also necessary to identify their satisfaction with the BSE graduates.

In this research, we have used a case study approach and identified two focus groups for the survey: BSE graduates and their employers. Since the inception in 2009, seven batches of students have enrolled to the programme and 53 students have graduated up to date. Therefore, a questionnaire was sent to all graduates to collect information for the following research questions:

- How long they had to wait to gain employment
- Whether they were able to cover the gap between what they learnt and what the industry required
- What the components of the programme that were helpful to find an employment
- Whether the online, flexible, learning was helpful for them to do their work

Likewise, another questionnaire was sent to selected employers to collect information on the following:

- Whether they are satisfied with the attitudes, technical skills and soft skills of BSE graduates
- How graduates adapted to their working environment
- What their perceptions are to make the degree more effective

The progress of the BSE programme in terms of number graduates enrolled and graduated by end of academic year 2014/2015 is given in the Table 1 and employers of the BSE graduates those who have responded out of selected set for the survey are given in the Table 2 with the company information.

Table 1: Student enrolment and graduate output by end of academic year 2014/2015

Year of Enrolment	No. of students enrolled			No of Students Graduated
	New	Reregistered	Total	
2009	53	-	53	-
2010	65	34	99	02
2011	60	66	126	08
2012	55	87	142	20
2013	54	88	142	16
2014	47	92	139	07

Table 2. Selected employers for the survey.

	Primary business type: Software development	CMMI level	No. of employees in Sri Lanka	No. of years in business	No. of BSE graduates currently employed	No. of BSE graduates employed and resigned
Company 1 (Global operations)	Yes	5	3000	17	7	3
Company 2	Yes	3	84	12	2	1
Company 3	Yes	3	200	12	1	2
Company 4 – Consultancy (Global operations)	No	Not Applicable	450	30	3	0
Organization in Higher Education	No	Not Applicable	Not given	48	1	0

Analysis of the Results

There are 38 (72%) responses from the graduates and five from the companies and an organization in higher education. According to the responses of the BSE graduates, 63% were unemployed before they joined the BSE programme. By the time they graduated 100% of them have had employment making the waiting time to get a job after graduation zero. Out of the employed intake, only nine students were in a relevant field to software engineering like BPO/Web design/software development etc. After graduation, seven of them have been promoted in their current employment.

It is evident from the survey that most of the BSE graduates had opportunities to work in the IT industry and enhance their career while following the degree in Software Engineering. According to the feedback given by the graduates, two have migrated to Australia having scored high marks for skill assessment by Australian Computer Society. There are two entrepreneurs and they have started their own companies after working for few years in the software industry. There is a lecturer working at a national university and a teacher educator in ICT in the Ministry of Education. One graduate is in Australia reading for a PhD in Biomedical Engineering. The rest of the graduates are working in different software development companies in Sri Lanka or abroad.

It is noted that the feedback from employers vary depending on the technical skill level and the soft skill level of a graduate. Even from the same organization, we received different feedbacks for the software related skill level of a fresh graduate. One company said the BSE graduates have more than the expected skill level of the organization. However, two companies indicated that graduates are below the expected skill level, but they provide training for the new recruits. According to the analysis, it is evident that many CMMI level 3 & 5 companies provide training to

new recruits while smaller companies and start-ups expect graduates to work on projects from day one. Regarding the special skills they see in BSE graduates one company has mentioned

“... Good team players, good commitment, and ability to switch between technologies...”

The most critical negative point we received is that the OUSL graduates are “...relaxed and take more than average time to do something...” which they have attributed to inherent nature of ODL that provide flexibility to students to complete their studies.

In relation to the feedback given by the graduates, they have not found it hard to adjust to the new environment because of the experience they have gained from industrial placement. Nevertheless, employers think that graduates need about three months to become full confident on working in their organizations. All most all organizations that answered the survey questionnaire and the interview have said they would like to hire another graduate from the BSE, OUSL.

As stated by the employers, to become a degree more effective it should have components with more practical project work in order to get hands on experience and technical competencies. Further, they have indicated that degree should be enriched with activities from which students can acquire communication skills, management skill, skills for performing work independently and under pressure. On the other hand, graduates replied that Mini Projects, Industrial training and Practical classes helped them most to be employed among other components as given in Figure 1. Moreover, they gave positive comments relevant to the activities and mode of learning such as

“Mini Projects were the most effective mechanism which I want to highlight, because those were the real industry level experience we have to face. Completing those before joining a job makes the job very easy ...”;

“..... The key factor is distance learning. also enhanced the capability of out-of-the-box thinking which is a very important factor in software development”.

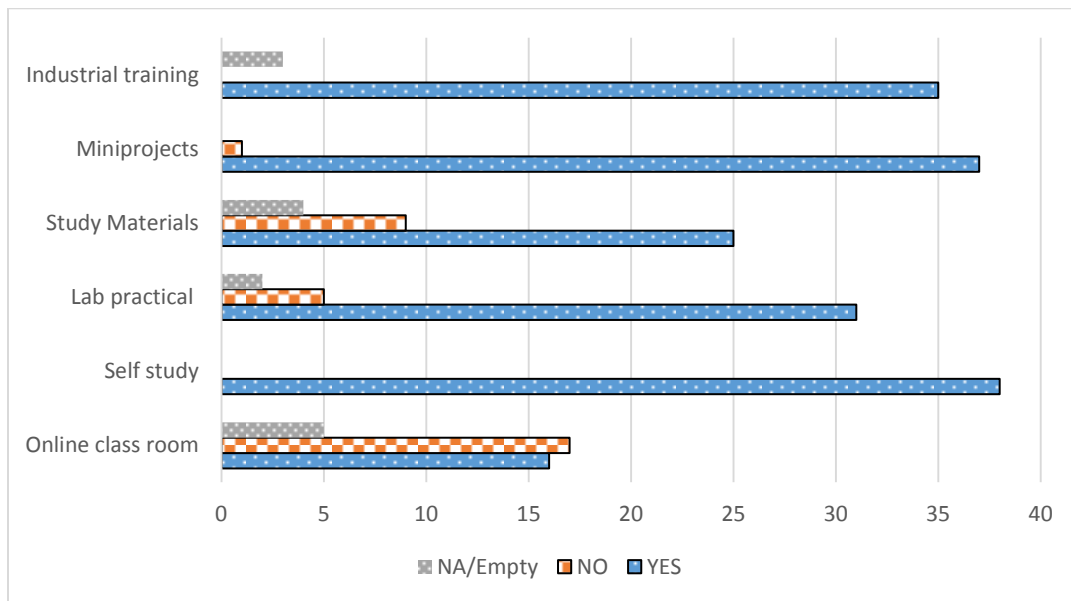


Figure 1. Components of the degree programme that were helpful to graduates to get an employment

Conclusion

From this research, we can conclude that BSE Graduates have the potential to find employment opportunities during the undergraduate tenure itself with zero waiting time. This is a great achievement for a degree programme delivered in open, distance and flexible mode. It is evident that the BSE graduates were able to find appropriate employment according to their qualifications and they could meet their employment expectations. As a result of this research it is proved that the BSE degree has been highly effective in terms of employability.

According to the analysis, the effectiveness of the degree programme has been achieved due to carefully designed curriculum. The curriculum incorporates industrial training and final year group project as compulsory components, which help the students to have workplace experience and build teamwork, managerial skills, and communication skills. Moreover, activities such as mini-projects and practical classes that are inbuilt into most of the courses contributed to get hands on experience in up-to-date technology.

Employers of the BSE Graduates have provided positive feedback to indicate that they are satisfied with the BSE graduates. Thus, we can conclude that the effectiveness of the BSE degree programme is high and it has been a timely and effective venture to enhance the IT workforce in Sri Lanka.

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