Journal of Learning for Development – JL4D
ISSN: 2311-1550
2023, Vol. 10, No. 2, pp. 236-251

Feasibility of Work-Based Learning Model for Undergraduate Engineering and Technology Programmes in Tanzania

Mwajuma Ibrahim Lingwanda

Mbeya University of Science and Technology, Tanzania

Abstract: This study proposes a new approach to teaching-learning in engineering and technology programmes at the undergraduate level in Tanzania, and evaluates its feasibility. The rationale was to improve flexibility in learning by providing learners with alternative programmes to choose from. A conceptual model was introduced showing how the work-based approach can be implemented in training diploma holders to acquire bachelor's degrees. A survey type of study with a mix of open- and closed-ended questions issued to a sample of 150 finalist students was conducted. The sampled population was all finalyear diploma students pursuing engineering and technology programmes at Mbeya University of Science and Technology in Tanzania. A stratified random sampling approach was followed to obtain the sample. More than 93% of the respondents supported the establishment of work-based programmes. This study, therefore, recommends, amongst other things, that Tanzanian learning institutions should set a pilot programme to test the effectiveness and practicability of this model.

Keywords: work-based learning, flexible learning, engineering and technology training, training model.

Introduction

Engineering and Technology are separate but intimately related disciplines that are often mistakenly used in place of one another. Both engineers and technologists require formal training to acquire specific attributes pertaining to their discipline. Degree programmes prepare engineers to apply mathematical and scientific principles to find solutions to practical problems, and technologists to apply basic engineering principles and technical skills to support engineering and related projects. Until very recently, most degree programmes in engineering and technology were offered through face-to-face classrooms. Connor et al. (2015) termed this approach a "chalk and talk" (p. 38) pedagogy that has proven to be ineffective but is still applicable in most Science, Technology, Engineering and Mathematics (STEM) learning. Thanks to the technological advancement in information and communication, an impressive number of engineering courses are now offered online by reputable universities worldwide as part of blended programmes.

The most common model for engineering and technology training embraced by universities in Tanzania uses solidly established curricula that are implemented by traditional face-to-face teaching. A little flexibility is usually offered in the form of elective courses for students to choose from. To enhance practical learning, there is usually a provision of time for students to be attached to relevant firms/institutions for what is called field training or industrial practical

training. For the bachelor's degree programmes of engineering and technology, the total training time varies between three to five years. Within these training periods, students are expected to acquire approximately 8 to 10 weeks of practical industrial experience in every academic year in which the programme lasts. The prerequisites for enrolment in engineering and technology degrees are usually advanced level education in the sciences, and a relevant technology/engineering diploma or its equivalent. The less flexible nature of engineering training in Tanzania and the cultural difference between engineering training and practice noted by MacLeod (2010), need to be fixed by introducing new teaching —learning models.

The main concern of this paper is the non-flexible nature of engineering and technology training in Tanzania, where everyone who is interested in pursuing a bachelor's degree in engineering or technology is constrained to pass through the same route, irrespective of their previous educational background, experience or personal interests. For example, those who possess a diploma in engineering/technology and those with an advanced certificate in secondary education are treated equally by the university system; sitting in the same class, both pursuing a bachelor's degree in engineering or technology for the duration specified by their curricula. Meanwhile, training programmes are supposed to keep pace with the rapid changes in knowledge and practice that the world undergoes (Baldwin & Baumann, 2005). There is a need to strategise to make sure that flexible, up-to-date, industry relevant programmes are made available to professionals (Ferguson, 1998).

Flexibility in Learning

The concept of flexibility in learning was well discussed by Collis and Moonen (2002), who also summarised it to mean learner choice. In that context, when the learner has a range of options to choose from then the kind of training received is flexible. Some institutions may have different definitions of flexibility, such as the one adopted by Palmer (2001) which emphasised the fulfilment of several dimensions for a programme to qualify as flexible. In this paper, the adopted definition of flexible learning is that by Collis and Moonen (2002) and does not necessarily have more than one dimension.

More often, the tendency of many is to think of learning flexibility in terms of distance. However, this only narrows the scope of the definition for there are several dimensions of flexibility in learning other than distance (Collis & Moonen, 2002). The other dimensions may be programme flexibility to accommodate learners' needs and interests, types of interactions during studying, time to accomplish the programme or study materials and many more as decided by the offering institution. Recent scholars such as Wanner and Palmer (2015) have submitted that flexibility needs to be extended to incorporate students' choices concerning assessment methods and formats. Although not a new concept, flexibility in learning is less explored in the education system in Tanzania than the distance dimension. One obvious advantage of flexibility is that of allowing a wide variety of learners to participate in a programme, as explained by Pon-Barry et al. (2019) hence, its inclusiveness.

The technological advancement in the world brought about transformation in the world of work by, for example, the introduction of digital labour platforms where work is outsourced through an open call to geographically dispersed individuals. This is to say, a range of new skills are required for the future labour market. Salmon (2019) ascertained the future for work to be more diverse, demanding and flexible. This should be reflected by the kind of training that is offered in academic institutions. On the other hand, the application and advocacy of flexible, online, technology-enhanced learning has gained more popularity after the outbreak of Covid-19, when

many institutions had no choice but to rely on flexible approaches in offering their programmes despite being unprepared (Mtebe et al., 2021).

Work-Based Learning

Work-based learning and similar approaches such as workplace learning, work-integrated learning, action learning and work-related training has found practice in several countries, including Algeria, Australia, Singapore, Fiji, Turkey, Morocco, Germany, Sweden, India, Malaysia, the Philippines and Sri Lanka (Sweet, 2018). According to Lester and Costley (2010), work-based learning refers to all and any learning that is situated in the workplace or arises directly out of workplace concerns. This definition will also incorporate such learning structures as internships, practicums, field work and cooperative education (Fleming & Haigh, 2018). Work-based learning may be structured or unstructured and offered in a systematic way or not (Sweet, 2018). A great majority of work-based learning is not accredited or otherwise formally recognised. However, this study was concerned with a formal training taking place at least partially at the workplace and leading to the award of a bachelor's degree.

The variety in workplaces and the contextual differences in learning programmes make it impossible to have a generic model for work-based learning. The important aspect of any adopted model is the learners' ability to integrate knowledge acquired in academic studies to make sense of workplace experiences (Fleming & Haigh, 2018). The model proposed in this study has objectively considered this attribute of learning by clearly indicating the requirement for learners to study and relate theory to what is learned through work. Moreover, any curriculum developed out of the proposed model should clearly capture how knowledge will be acquired, applied and evaluated. Studies by Billett (1995) and Billett (2000) emphasise the establishment of curricula to guide workplace learning for it to be successful. Courses in a work–based learning programme may be designed by the academic institution, the learners or the industry as key stakeholders. Engaging the learner or the employer creates a sense of ownership to the new course. However, the academic institution should retain the other two important roles of managing the learning process and evaluating the learning to determine its academic merit (Linehan & Sheridan, 2009). Literature shows that work-based learning and related concepts can successfully be applied to train both undergraduate and postgraduate students (O'Connor, 2004).

The Proposed Model

The proposed conceptual model presented in Figure 1 is elaborated in the following subsections:

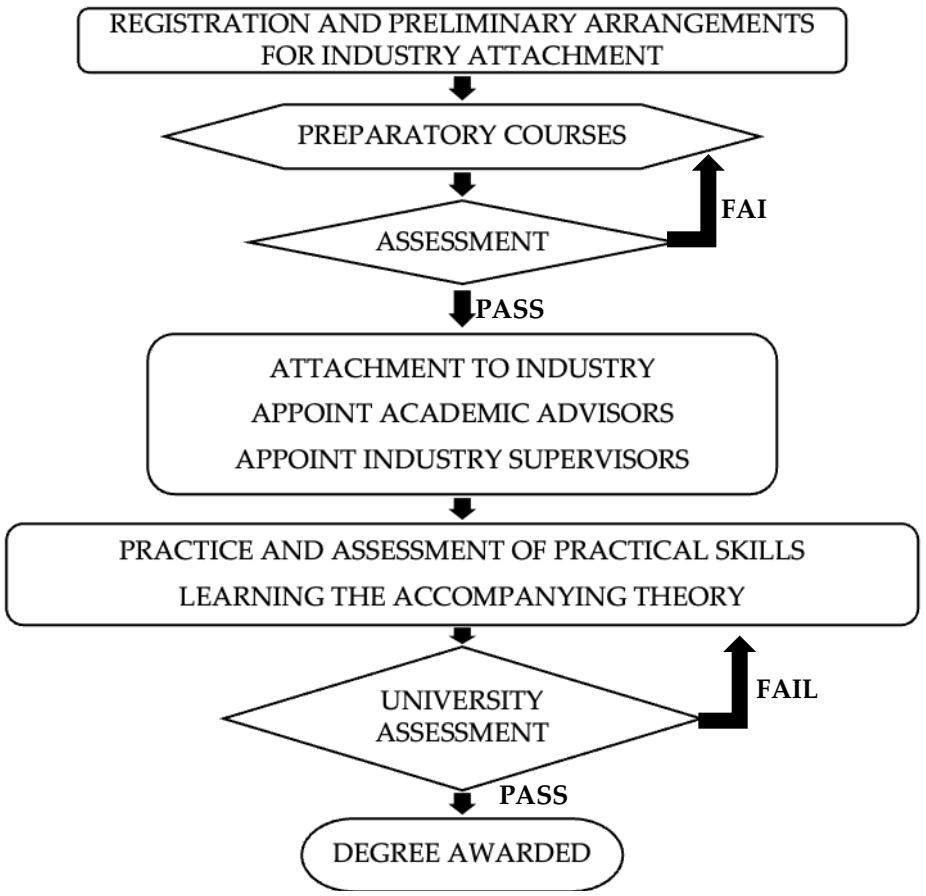

Figure 1: Schematic diagram for the proposed work-based learning model

Registration and Preliminary Arrangements for Practical Attachment

Just like most curricula, a curriculum prepared to entail this model should prescribe minimum qualifications for joining into the particular programme. After applications are processed and selected candidates should first be registered in the programme as is commonly done in other programmes. It is strongly proposed in this paper that candidates for work-based learning should have acquired a relevant engineering/technology diploma prior to joining a bachelor's degree programme. This is a crucial requirement because the candidate will need to have basic skills relevant to the workplace.

During registration, the university should start the process of solicitating workplaces for attaching the students. This can be achieved by involving the students because some of them may already be working in the industry and may wish to proceed with their current employer. The process of communication and solicitation of learning places should involve assessment of the same to ensure the appropriateness of anticipated learning activities and availability of personnel who will act as industrial supervisors to the students.

Working and Learning the Theory

During the learning period, the student attached to the industry will be required to perform duties as assigned by their supervisor and create a work record in a logbook indicating dates, tasks performed and their respective details. The industry supervisor will have to endorse what is written in the logbook upon the successful performance of each task listed. Simultaneously, the student will be required to consult the university advisor for guidance on the theory part. Upon

agreement with the advisor, the student will be required to gather theoretical information about the practical work that has just been learned. The student will be required to study the theory and be able to explain the link between the theory and practice. The university advisor will guide the student on the details of the theory including how wide and deep it should be. Also. in this period, the university advisor will visit the student in the workplace to evaluate his/her progress. The frequency and interval of visits should be indicated in the respective curriculum.

University Assessment and Award of Degree

Students will be required to produce evidence to support their claims of learning. Common tools considered for assessment are presentation, a reflective interview and a reflective portfolio (Brodie & Irving, 2007). It is proposed in this model that after a stated study period (say, a year or a semester), the student should submit the work logbook that comprises the detailed activities accomplished, and the respectively learned theory, to the university for assessment. The student will be required to present the report (preferably orally) with a focus on the link between theory and practice. The assessment should consider the fact that learning is a necessary condition for every experience (Herman & Mandell, 2015) and, thus, one does not get any credit from their experience unless there is something learned from it. After the presentation, the student will be awarded some units. The curricula should prescribe the minimum units that the students will have to acquire to qualify for a bachelor's degree.

Objectives of the Study

This study had two main objectives:

(i) To introduce a new model for training bachelor's degree students, particularly in engineering and technology programmes, in Tanzania.
(ii) To determine the feasibility of the proposed model based on responses obtained from prospective learners.

The rationale of introducing this model was to increase flexibility in learning so students would have several modes of learning to choose from, instead of the current situation where everyone has to fit into the traditional model. As pointed out by Helyer, (2015) people who are likely to prefer work-based learning are those who don't find off-the-shelf university courses useful and, thus, require more tailored learning experiences. The newly proposed model recognises that diploma holders have prior professional training and are, therefore, capable of offering professional services at a certain level. Therefore, their training for a bachelor's degree may be different from advanced secondary school certificate holders. Sweet, (2018) has listed employers, learners, employees, public employment service, schools and colleges, and education/training administrators as the key stakeholders in work-based learning. This study has chosen to focus on learners' information, opinions and perceptions about the model. However, it does not mean that other stakeholders' opinions are of less importance. It is emphasised that other stakeholders' opinions should be considered during development of respective curricula based on the model, which is what is normally done when establishing new university programmes or reviewing existing ones.

Methods

The conceptual model in Figure 1 was established to communicate the whole idea of work-based learning so that it can easily be understood by stakeholders. The model has captured essential features of the proposed work-based learning in a manner that can stimulate discussion about

applicability or improvement of any part of the system. Fine details about any part of the model are supposed to be captured in specific curricula developed to implement the model. Experience coupled with literature information was applied in the process of developing this model. After that, the main objective of the study became establishment of the feasibility of the model based on data from relevant stakeholders. The following sub sections describe the methods used in studying the feasibility of the model.

Research Methodology

The nature of this study required collection of both qualitative and quantitative information. The purpose of conducting a quantitative study was to discover quantities (how many) and the kind of particular characteristics that exist in the sample with the aim of making inferences to the population. Conversely, in qualitative study, the concepts and categories of characteristics are what matters and not the inference and frequency (Brannen & Coram, 1992). The study wanted to establish the feasibility of the model by determining the proportion of respondents that support its applicability and, at the same time, get stakeholders' opinions that support or oppose the model. In this case, a mixed research approach was applied in data collection. The methodology chosen for data collection involved a survey.

Tools

A questionnaire was prepared that contained a few closed-ended questions for collection of quantitative data and a number of open-ended questions aimed for both qualitative and quantitative data. The questions intended to obtain respondents' perception about the model, improvement suggestions, advantages and disadvantages of the model, anticipated challenges in operating the model, as well as getting general opinions about the model. To improve the reliability and validity of the tool, data collection started with a pilot study, where 12 questionnaires were distributed and collected back with improvement suggestions from stakeholders. The improved questionnaire was then issued to the whole sample. A second set of questionnaires was intended for trainers. This also had questions regarding trainers' perception about the model, improvement suggestions for the model, advantages and disadvantages of the model, anticipated challenges in operating the model as well as getting general opinion about the model.

Population and Sample

The target population was all diploma holders in engineering and technology programmes all over Tanzania. However, for convenience, the sampled population was diploma finalists from Mbeya University of Science and Technology who were pursuing engineering and technology programmes in 2022. In that year, there were about 930 finalists from 14 different programmes. To determine the sample size, reference was made to the table suggested by Bartlett et al. (2001) which provides sample sizes appropriate for many sampling problems. With a margin of error of 3% and an alpha value of 5%, a sample size of 106 was found to be suitable for this study. Assuming a return rate of 60%, the sample size was rounded to 150. Stratified random sampling was applied by first conveniently considering programmes where classes were attended on a particular day and at a particular time. Then, the 150 questionnaires were distributed randomly to students that were in classes. In addition to students, five heads of departments that offer engineering and technology courses were issued the second set of questionnaires to provide information that could enrich the study.

Results

From the sample of 150 students, 122 questionnaires were successfully retrieved. Responses received were grouped into the following key results: perception about the proposed model, anticipated advantages of the model, anticipated challenges to different stakeholders during implementation and general opinions about the model. Frequencies and percentages were determined for each key result thereafter plotted in pie charts. The following sections summarise the findings from the respondents.

Respondents' Perception about the Proposed Model

The results of the analysis indicate that only 3.3% of the respondents were sceptical about the functioning of the model and the remaining 93.7% think the proposed model will work. About 3.4% of respondents who think the model will work have indicated no interest in pursuing studies of this nature. The remaining 96.6% have indicated their readiness to enrol in a programme that runs in the proposed setup. Those who were reserved about implementation of the model indicated the following reasons:

(i) The awarded degree will have limited application;

(ii) The cost of running the programme will be too high;

(iii) They are worried about quality control for work-based programmes in general;

(iv) Not many enterprises will be ready to accept students for work-based training.

Respondents' Suggestions for Improving the Proposed Model

Respondents were asked to give suggestions on how the proposed model could be improved. Only 64 students (52.5%) that responded had something to say about improvements. Because this was an open-ended question, there were a variety of responses. Suggestions that were given are presented in Figure 2, where "others" represent all suggestions given by a smaller percentage of respondents less than 3% of the total. The trainers' response to model improvement suggest the following:

(i) Make the model more detailed to include such issues as competence expected at each stage of learning, monitoring and supervision of the training while at the industry, and

(ii) Make the curriculum very detailed to ensure that expected competencies are achieved.

Respondents' Opinion about Advantages of the Model

Trainers think that the model, when implemented, will bring the following advantages:

(i) Since it is learner centred, it will enhance competence-based learning;

(ii) Employees will have no fear of losing their jobs when seeking further studies;

(iii) The model will help cut the training cost of respective training institutions.

Prospective students' anticipated model advantages are summarised in Figure 3 where a significant percentage of respondents think this form of learning will enhance practical skills, provide exposure to learners, enhance both practical and theoretical learning, save time, and reduce unemployment.

Anticipated Challenges to Students

As indicated in Figure 4, a significant percentage of responses from students listed two major challenges: achieving a work-study balance (time management), and financial difficulties in case

students will have to work without pay. Trainers, on their side, anticipate the following major challenges of the model to students:

(i) Students undertaking such kinds of programmes will lack guidance and end up losing focus on their studies, and

(ii) Students are supposed to be independent, an attribute that many of them may lack.

Anticipated Challenges to the Implementing University

The researcher wanted opinions about the kind of challenges that universities implementing work-based programmes may face. Prospective students' responses to this question are indicated in Figure 5, where a large percentage of respondents seem to think that major issues will be high running costs of such programmes and finding right workplaces to attach the students. The trainers responded by indicating the following challenges:

(i) Quality control during implementation of the programmes;

(ii) Difficulty in forming partnership with the industry to assist in the training;

(iii) Willingness of the industry to offer such long-term training to students;

(iv) Getting reliable workplaces willing to take the training responsibility.

Anticipated Challenges to the Industry

The responding trainers listed two major challenges on the side of the participating industry:

(i) The model being new in the country, it will take time for the industry to comprehend about how it works;

(ii) The industry will face extra load in arranging relevant activities for the students to learn from.

Prospective students think that the major concern should be the extra responsibility for the industry to train students. A summary of students' responses is indicated in Figure 6.

General Opinions about the Model

The respondents were asked to provide any comments with regard to the model. Responses from the trainers were as follows:

(i) That preparatory courses to be offered in stages rather than just at the beginning of the programme;

(ii) The model is generally good and might offer competent graduates, however, it may need improvement after observations on its performance using a pilot programme.

Prospective students had a lot to say in general about the model. However, as indicated in Figure 7, most of them think that the model is good and should be implemented immediately.

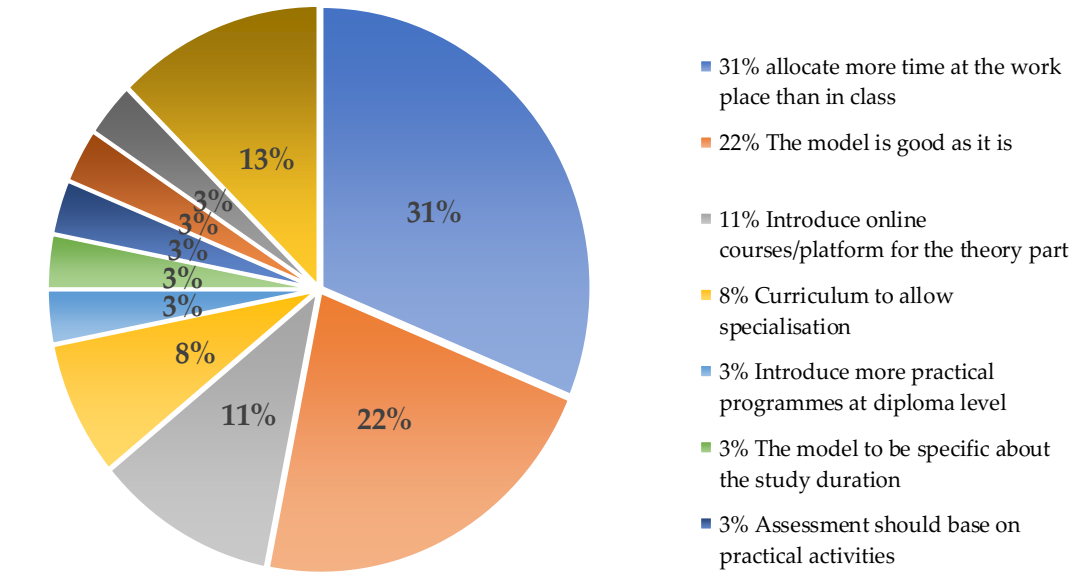

Figure 2: Prospective students' suggestions on improving the model.

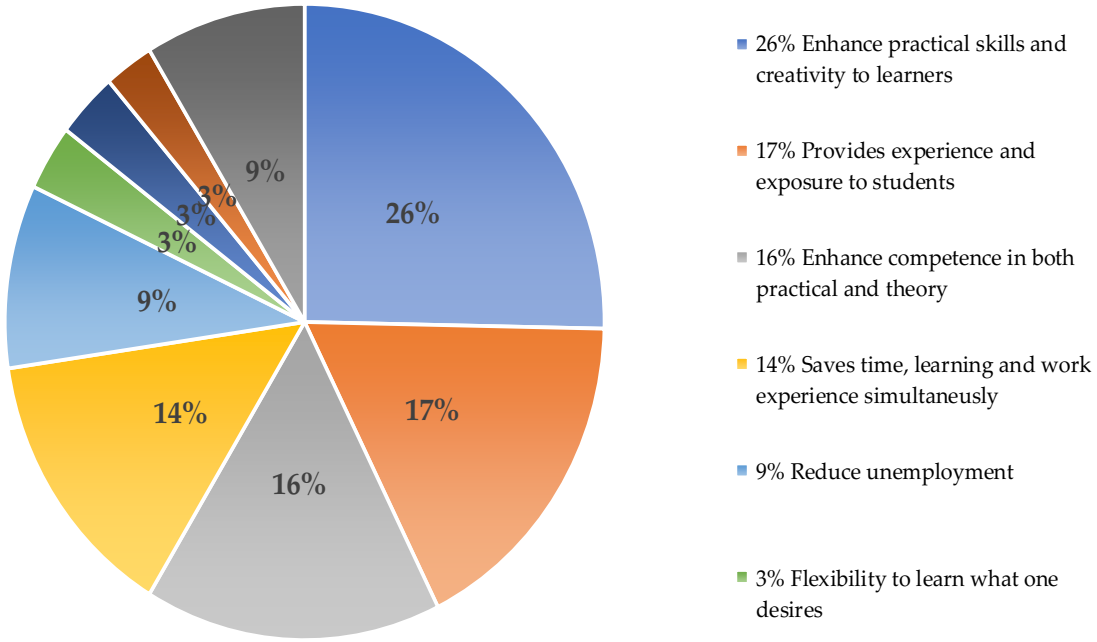

Figure 3: Prospective students' suggested model advantages.

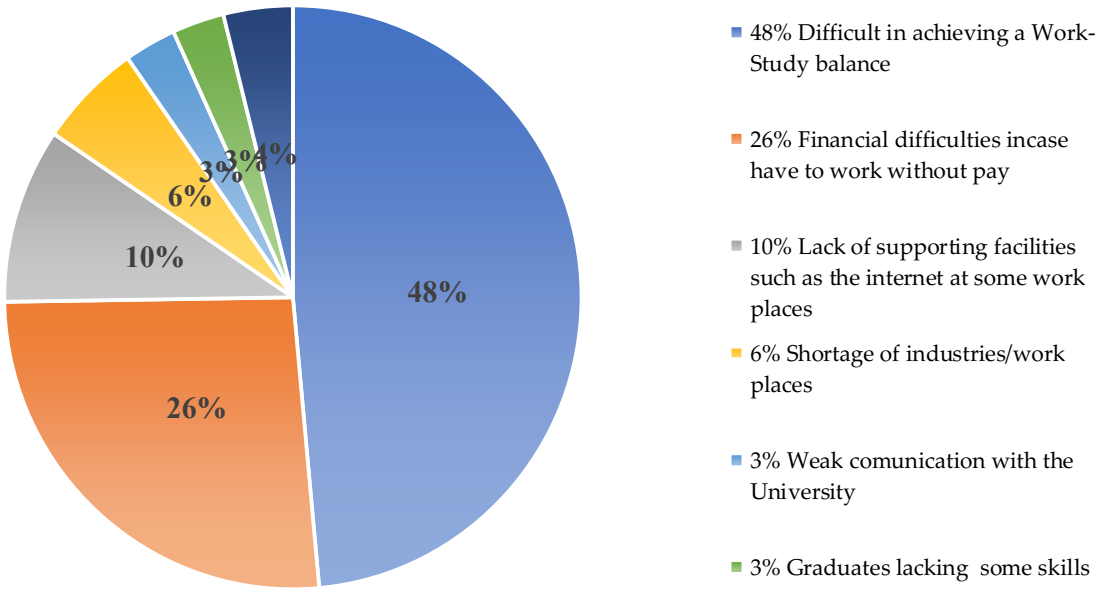

Figure 4: Prospective students' anticipated challenges.

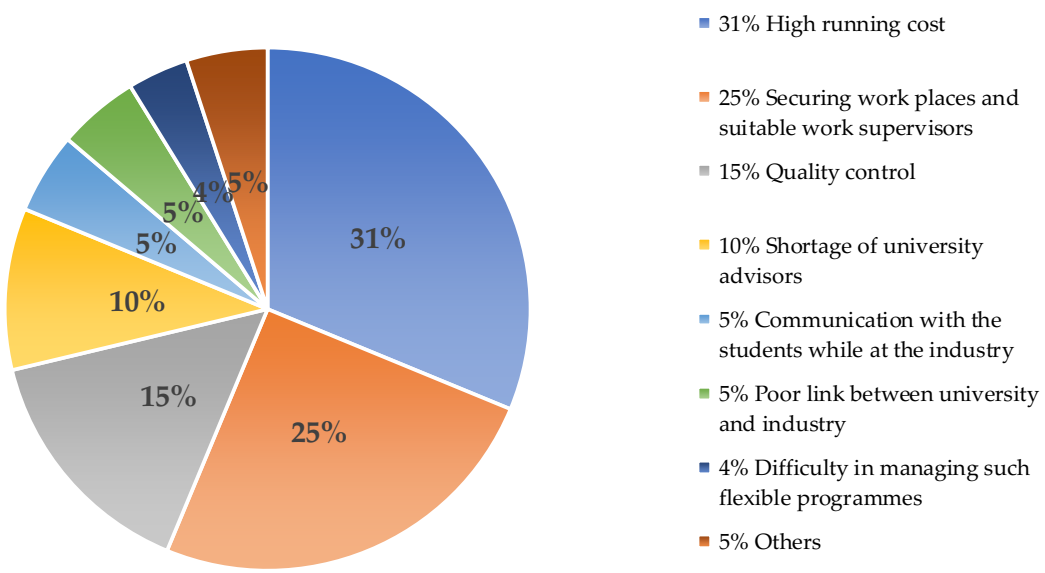

Figure 5: Anticipated challenges to the implementing university.

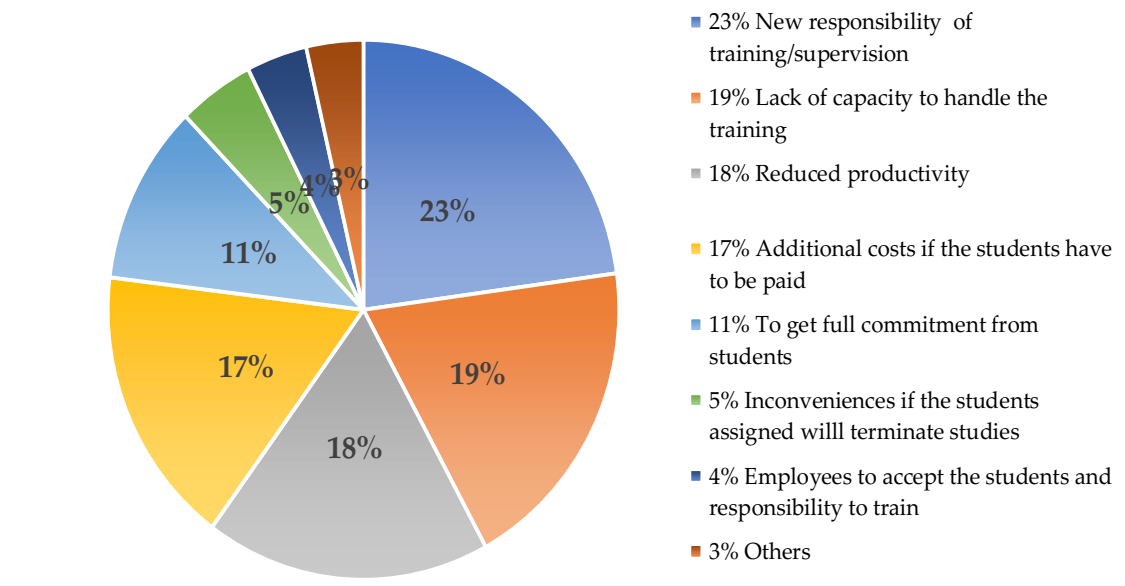

Figure 6: Anticipated challenges to the industry.

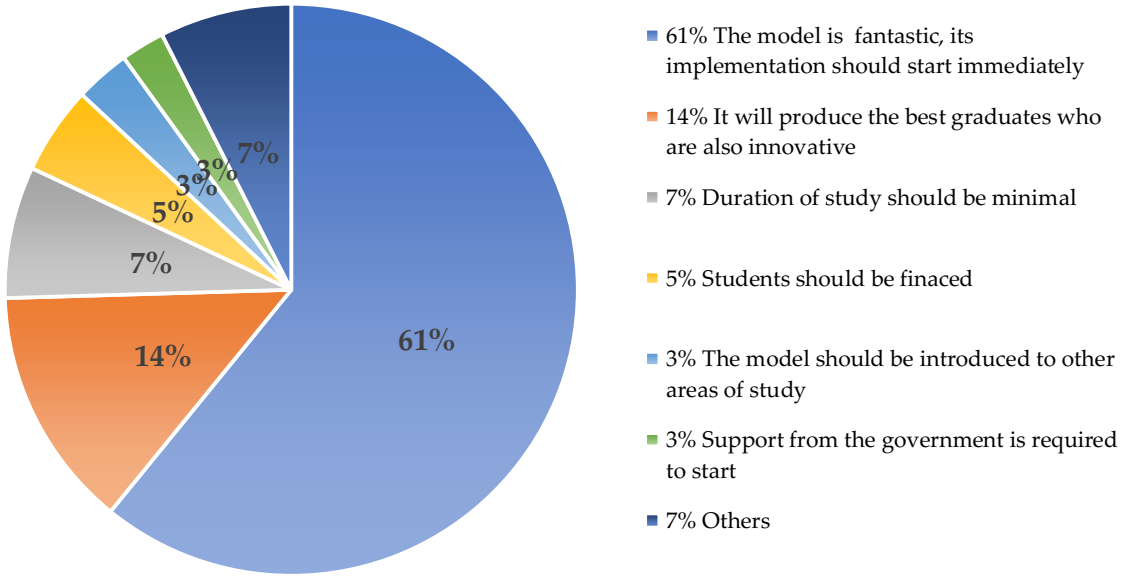

Figure 7: Prospective students' general opinions about the proposed learning model.

Discussion of Results

The book by Sweet (2018) contains information very relevant to this study because it focuses on low- and middle-income countries implementing different kinds of work-based learning programmes. Together with other literature, information and experiences from these countries are, therefore, an important reference when discussing different issues that emerged during data collection. For easy reference, the discussion is presented in seven sections relating to the identified key issues as follows.

(i) Perception about the Proposed Model

Contrary to what respondents of this study worry about work-based learning having limited application and low quality, Sweet (2018) reported that work-based programmes make study more interesting and connect students to the real world of jobs. Since students are given more relevant work skills, work-based programmes expand employment opportunities to students. There is also a possibility of graduates being employed in the firm where they trained immediately after completing their studies, which is an added advantage.

The prospective students' concerns about the cost of work-based training should not be ignored, especially considering the current practice of cost sharing between the government and students. However, if industry is ready to share the cost, the government and public will have their burden eased and more students will probably be supported in their studies.

It is fine for the respondents to be worried about the quality of training in the proposed model. This is because quality is of ultimate importance in any education system and work-based learning is a new concept in Tanzania. However, people should be informed that some countries have been implementing similar concepts for years. Brodie and Irving (2007) reported that work-based learning has been implemented in the UK system of higher education for more than 30 years now. However key issues, such as assessment in work-based learning, are still discussed and improved. We should be reminded that the quest for quality improvement, especially in education, is endless.

(ii) Model Improvement Suggestions

A significant number of respondents (prospective students) proposed more time be dedicated to actual work than classroom theory. Supported by the literature, this model recommends for learning time between classes and work to be established for specific programmes and be clearly stated in the respective curricula. For example, Sweet (2018) reported that, in Algeria, trainees spend an initial short period in full-time training, followed by alternate times spent between work and training while, in Egypt, trainees spend two years in full-time training followed by a year of alternating between the workplace and the classroom.

(iii) Model Advantages

Engineering and technology programmes often require universities to possess equipment and machinery for training purposes. The equipment is usually very expensive, making it difficult for universities to keep up with technological changes. Sweet (2018) has shown that work-based programmes can allow universities to offer training using employers' equipment, therefore, reducing the need to purchase expensive equipment. Work-based learning may not necessarily reduce training costs to universities but, rather, introduce a new form of cost sharing where universities use equipment in the industry to train students.

Respondents had opinions that work-based learning enhances practical skills, provides work experience, gives chances for exposure and enhances competence in theory and practice. All these attributes contribute to professionalism. As commented on by Metso and Kianto (2014), learning which takes place at work has the potency to train learners in acquiring professional skills and competence. Another great advantage of work-based learning is that it strengthens the synergy between training institutions and industry and creates strong links between individuals as well as between institutions.

Work-based learning is an opportunity for mature-age students in the workplace to upgrade their qualifications. Many will agree that it is unrealistic to expect all organisations to release staff to attend full-time, on-campus studies (Palmer, 2001).

(iv) Anticipated Challenges to Students during Studies

Some trainers worried that students undertaking work-based programmes might end up being less confident because of the learning environment being mostly self-study with regard to theory. However, Sweet (2018) indicated that work-based learning graduates are more likely to get jobs, as their skills are more relevant to employers' needs, they possess better basic work habits, and their bonds with employers are stronger.

Students responding to this study questionnaire indicated their worries about achieving a good work-study balance. This is to say, the respondents thought there should be a separation between working and learning. However, the overall concept of work-based learning in the context of this study is that the actual learning experience is achieved through working. Billett and Choy (2013) greatly acknowledged the difficulty in managing how students learn at workplaces, because learning is directed towards the needs of the workplace. This area will definitely need to have strategies stipulated in the respective curricula to ensure that key stakeholders achieve their expectations. However, Billett and Choy (2013) warned that attempting to use concepts and practices from educational institutions alone will not provide a suitable solution. Therefore, there is need to involve all relevant stakeholders during the curricula development phase.

Some trainers worried about the demanding nature of work-based training proposed in this study and the fact that the model needs students to be more self-reliant. This agrees with Helyer's (2011) comments about the nature of work-based learning that it is a different but not an easier or lesser way of obtaining a higher education qualification. Work-based learning is generally more demanding for students. Therefore, students are urged to be self-motivated and independent as they cannot wait for teachers to appear with fixed timetables and content. Students' self-drive was listed by Metso and Kianto (2014) as one of the factors impacting the development of professional competence. However, the work environment presents a great contribution to motivating learning, including positive evaluation, which the learners receive from co-workers and supervisors.

(v) Anticipated Challenges to the Implementing Universities

Respondents had indicated their concern about the industry involvement in training, forming partnership with universities and willingness to take part in training students for such a long time. Similarly, Namjoshi (2020) identified the key challenge of running work-based programmes as ensuring the motivation and commitment of the actors involved. It is the view of this author that universities have a role to keep themselves and the rest of the stakeholders motivated and committed to implementing their programmes. Sweet (2018) has advised making the employers aware of the programmes and their benefits before engaging them in training. The guidelines for establishing new programmes in Tanzania require involvement of different stakeholders during the programme development phase. This implies that if the guidelines are strictly followed and the involvement of relevant stakeholders is massive, then universities are more likely to succeed in involving industry for work-based training.

(vi) Anticipated Challenges to the Industry

Industry has a major role to play in making work-based learning possible. Other than providing a conducive working place, the policy and presence of enriching academic processes are necessary

for effective learning. Namjoshi (2020) posited that exposure to new skills and interactions with mentors are all important for a rewarding learning experience. Therefore, for the success of work-based learning programmes, the industry should be ready to accept the responsibility of training. Employers are expected to be ready to assign some staff to support training which might lead to some additional operation costs.

Some of the challenges expected to face implementing enterprises, such as the lack of capacity to handle training, could be country specific. However, such issues as the implementing cost have been discussed by other researchers, too. Those who are familiar with work-based training would agree that work in work-based learning is not necessarily paid work: it can be any form of work or purposive activity that gives rise to learning (Lester & Costley, 2010). It may be voluntary or community based. Some respondents in this study showed concern for companies running up costs that may arise if they take in students and pay them for what they do while learning. This may or may not be true, depending on the setup or agreement between universities, training enterprises (industry) and the students.

Work-based learning may have more benefits to industry than anticipated challenges. For example, Sweet (2018) has shown that enterprises participating in work-based training might use it as an opportunity to recruit skilled workers in the future. The training itself may be done in a cost-neutral way, or even to gain a financial benefit, if wages and financing arrangements are well constructed.

(vii) General Opinions about the Model

Some of the issues pointed out by the respondents in this study such as where or when the preparatory courses are to be administered to students are issues of curricula development. The proposed model is intended to suggest the general framework for work-based learning without going too much into details, thus, leaving flexibility to accommodate other preferences during specific curriculum development.

Conclusion and Recommendation

A work-based learning model has been proposed for developing programmes to train diploma holders in engineering and technology to a bachelor's degree level. The rationale of the model is to improve flexibility in learning by giving learners an alternative to the existing traditional on-campus mode. Opinions from prospective students as well as trainers suggest feasibility of the model if applied. Prospective advantages and challenges of work-based learning have been discussed in light of experiences reported in the literature. Both prospective learners and trainers sampled from an academic institution support application of the model in Tanzania. Establishment of a pilot programme is recommended to ascertain the applicability and effectiveness of the proposed model while guided by the relatively rich literature on the topic. Conclusively, the observations of the respondents, particularly on perceived issues associated with this study have been noted. Thus, pilot studies and more research are needed by training experts to rightly position the model for effectiveness.

References

Baldwin, R.G., & Baumann, M.J. (2005). Options for change: A flexible vehicle for curriculum evolution and reform. *Innovative Higher Education*, *30*(2), 89-98.

Bartlett, J.E., Kotrlik, J.W. & Higgins, C.C. (2001). Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, 19, 43-50.

Billett, S. (1995). Workplace learning: Its potential and limitations. *Education + Training*, *37*(5), 20-27.

Billett, S. (2000). Guided learning at work. *Journal of Workplace learning*, *12*(7), 272-285.

Billett, S., & Choy, S. (2013). Learning through work: Emerging perspectives and new challenges. *Journal of Workplace Learning*, *25*(4), 264-276. doi:10.1108/13665621311316447.

Brannen, J., & Coram, T. (Eds.). (1992). *Mixing methods: Qualitative and quantitative research* (Vol. 5). Avebury. https://doi.org/10.4324/9781315248813.

Brodie, P., & Irving, K. (2007). Assessment in work-based learning: investigating a pedagogical approach to enhance student learning. *Assessment & Evaluation in Higher Education*, *32*(1), 11-19. doi:10.1080/02602930600848218.

Collis, B., & Moonen, J. (2002). Flexible learning in a digital world. *Open Learning: The Journal of Open, Distance and e-Learning*, *17*(3), 217-230. doi:10.1080/0268051022000048228.

Connor, A., Karmokar, S., & Whittington, C. (2015). From STEM to STEAM: Strategies for enhancing engineering & technology education. *International Journal of Engineering Pedagogy*, *5*(2), 37-47. http://dx.doi.org/10.3991/ijep.v5i2.4458.

Ferguson, C. (1998). The continuous professional development of engineers and flexible learning strategies. *International Journal of Lifelong Education*, *17*(3). 173-183. doi:10.1080/0260137980170303.

Fleming, J., & Haigh, N.J. (2018). Using sociocultural insights to enhance work-integrated learning. *Higher Education, Skills and Work-Based Learning*, *8*(4), 395-407.

Herman, L., & Mandell, A. (2015). Experiential learnings revised. *Journal of Learning for Development*, *2*(1). https://files.eric.ed.gov/fulltext/EJ1106125.pdf

Helyer, R. (2011). Aligning higher education with the world of work. *Higher Education, Skills and Work-Based Learning*, *1*(2), 95-105.

Helyer, R. (2015). Learning through reflection: The critical role of reflection in work-based learning (WBL). *Journal of Work-Applied Management*, *7*(1), 15-27.

Lester, S., & Costley, C. (2010). Work-based learning at higher education level: Value, practice and critique. *Studies in Higher Education*, *35*(5), 561-575. doi:10.1080/03075070903216635.

Linehan, M., & Sheridan, I. (2009). Workplace learning courses in Irish third-level colleges. *Journal of Workplace Learning*, *21*(6), 496-504. doi:10.1108/13665620910976766.

MacLeod, I.A. (2010). The education of innovative engineers. *Engineering, construction and architectural management*, *17*(1), 21-34. doi:10.1108/09699981011011294.

Metso, S., & Kianto, A. (2014). Vocational students' perspective on professional skills workplace learning. *Journal of Workplace Learning*, *26*(2), 128-148.

Mtebe, J.S., Fulgence, K., & Gallagher, M.S. (2021). COVID-19 and technology enhanced teaching in higher education in Sub-Saharan Africa: A case of the University of Dar es Salaam, Tanzania. *Journal of Learning for Development*, *8*(2), 383-397.

Namjoshi, R. (2020). The role of industry in implementing work-based learning pedagogy. *Work Based Learning e-Journal International*, *9*(1), 132-146.

O'Connor, B.N. (2004). The workplace learning cycle: A problem-based curriculum model for the preparation of workplace learning professionals. *Journal of Workplace Learning*, *16*(6), 341-349. doi:10.1108/13665620410550312.

Palmer, S. (2001). Engineering flexible teaching and learning in engineering education. *European Journal of Engineering Education*, *26*(1), 1-13. doi:10.1080/03043790010009149.

Pon-Barry, H., St. John, A., Packard, B.W.L., & Rotundo, B. (2019, February). A flexible curriculum for promoting inclusion through peer mentorship. In *Proceedings of the 50th ACM technical symposium on computer science education* (pp. 1116-1122).

Salmon, G. (2019). May the fourth be with you: Creating Education 4.0. *Journal of Learning for Development*, *6*(2), 95-115.

Sweet, R. (2018). *Work-based learning: A handbook for policy makers and social partners in ETF partner countries*. European Training Foundation. doi:10.2816/018079.

Wanner, T., & Palmer, E. (2015). Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course. *Computers & Education*, 88, 354-369.

Author:

Mwajuma Ibrahim Lingwanda is a Lecturer and the Principal of the College of Architecture and Construction Technology, Mbeya University of Science and Technology, Tanzania. Email: mwajumaling@gmail.com; wajuma.lingwanda@must.ac.tz

Cite this paper as: Lingwanda, M.I. (2023). Feasibility of work-based learning model for undergraduate engineering and technology programmes in Tanzania. *Journal of Learning for Development, 10*(2), 236-251.