Abstract—The purpose of mentorship is to supplement, support, and improve the learning experience of people. Since mentorship is a relationship between individuals, it requires dedication, trust, physical and emotional participation. It further involves various aspects such as listening, supporting, questioning, and supervising. In a mentorship process, there is always a mentor and a mentee, and the mentor has different roles to those of a mentee. Generally, in life individuals have always relied formally or informally on others to learn, grow, and gain experience in their respective fields. But the learning process has always not been comfortable. It consists of various activities such as mistakes, failures, lessons, and eventually accomplishments. The concept of mentoring has been well researched across various economic and academic sectors over many years. The paper will demonstrate how policy, technology, living lab, and skills management can help in implementing educational programs aimed at improving a mentee's performance and promote interactive learning. We will demonstrate these concepts by referring to our program Technical Application Mentorship Program (TAMP).

Index Terms—e-mentoring, mentee, mentor, mentoring

I. INTRODUCTION

A mentor is a trusted friend, counselor, or teacher; usually a more experienced person sharing his/her experiences with a less experienced person, in this case a mentee[1]. When one looks at the workplace, senior engineers are formally or informally assigned to a group of newly appointed juniors, and assist them throughout their induction period. According to [2], mentoring can simply be defined as a relationship between two individuals, where one is a mentor counseling a mentee (also called a protégé). Examples of successful people who have been mentored include Martin Luther King Jr; mentored by Benjamin Mays; and Richard Branson mentored by Freddie Laker; Aristotle mentored Alexander the Great; even Napoleon Hill was mentored. The literature pertinent to the the theory of mentoring is reviewed in section II.

In our program, the Technical Application Mentorship Program (TAMP), e-mentoring is used in order to accelerate the process of mentoring and where meeting face-to-face seem to be a challenge between a mentor and a mentee. TAMP is a cost-free program dedicated to assisting registered learners in the Faculty of Information and Communication Technology (ICT) at Tshwane University of Technology (TUT). TAMP Mentors are trained senior learners, who assist junior learners (mentees) with computer programming languages like COBOL, C++, JAVA, and VB.NET.

E-mentoring can be explained as a process where a mentee and a mentor communicate via ICT technologies in order to solve certain problems, or answer brief questions that a mentee may have. E-mentoring is encouraged in a situation where the relationship between a mentor and mentee has already developed. In our TAMP program e-mentoring is applied where mentors, who were part of the program, are employed in the Information and Communication Technology (ICT) industry and wish to continue with mentoring upcoming mentees.

Mentors who have graduated and are currently employed in the ICT industry have made themselves available to the program and are what TAMP calls Virtual Mentors and Advisory Committee to TAMP or ACTAMP for short. The use of technology, which has become so pervasive, gives the program the advantage of having a self-service setting, with mentees being able to login, diarize mentorship sessions, provide feedback, and also to plan their activities effectively.

Tools such as the World Wide Web (WWW) and other computer-related utilities (e.g. the TAMP website) are useful in further enhancing the process of mentorship, bridging the gap between skilled, experienced, knowledgeable individuals, and those who can benefit from these collective qualities when shared. Section III of this paper explains the topic of e-mentoring in great detail.

Applying the Living Lab approach for mentoring peers, experiences can be gained and shared among mentees with skills and better understanding in certain fields. Using this approach, people from different companies can also collaborate to create better mentorship programs that will enable companies to produce mentored and industry-prepared candidates. The Living Lab approach is unique in the sense that educators can also become part of the mentoring process, whereby they can also mentor the mentors where necessary. This will in turn improve the way mentees are being mentored by their peers.

According to [3] a Living Laboratory is an approach towards building the future innovation environment in which real-life driven innovation and research is a normal
technique for developing new products, services, and social infrastructure. The collaboration approach enables a development of useful and effective products and technologies. “A Living Lab takes advantage of creative talent, socio-cultural diversity, and the unpredictability of inventiveness and imagination of end-users” [3]. The generic mentoring theory is briefly discussed in section II below, followed by a discussion on e-mentoring in section III. We propose the Living Lab approach for TAMP in section IV. Finally, the paper looks at the benefits of e-mentoring in section V. The conclusion and the way forward appears in section VI.

II. MENTORING THEORY

Mentoring has been extensively researched for more than 32 years, with the first mention of the word in literature three thousand years ago [2]. The literature suggests two versions of mentoring, that is the “stern mentor” and the “friendly mentor”[2]. A stern mentor is a firm, alert, or cautious individual. The purpose of mentorship is to supplement, support, and improve the learning experience of learners. Since mentorship is a relationship between individuals, it requires dedication, trust, and both physical, and emotional participation. It further involves various aspects such as listening, supporting, questioning, and supervising. But it is not about being a psychologist or a disciplinarian.

Mentoring is generally common across all sectors of society and it takes different shapes in different settings, including paid and voluntary activities [2]. It is widely known that mentoring has been successful in:

• helping individuals to choose appropriate careers;
• helping learners to improve their grades and develop previously lacking skills;
• helping individuals in setting and achieving their goals; and
• encouraging positive behavior.

In a mentorship process, there is always a mentor and a mentee (learner), and the mentor has different roles to those of a mentee. [4] claims that a successful mentor is an encouraging, motivating, nurturing, and equipping mentor.

There are several benefits that can be acquired by stakeholders who are involved in a mentorship process. Some of the benefits are listed below:

• enhances chances of being employed; and
• broadens networks, thus increasing one’s contacts.

Besides the traditional mentoring, we believe that e-mentoring can play an important role. The next section covers e-mentoring as the state of the art.

III. E-MENTORING: STATE-OF-THE-ART

The concept of mentorship is well-known and information regarding this is readily available by pressing a button. It is widely implemented in the management and education environments [5]. e-Mentoring is one of the facets of mentoring and it started to gain popularity in the 1990s when teachers realized that e-mails might be easier and better way to connect with students [4].

According to [5], the TAMP website allows learners to book a mentor online. Learners can participate in activities such as mentor evaluation, surveys, competitions, brain teasers, workshops, joining computer societies, or downloading resources like the TAMP magazine, articles, general news, and forums.

Based on our skills management and policy experiences in TAMP, we believe that a mentoring program has to be meticulously managed and cannot be expected to produce results automatically after introduction. This requires that a competent project manager or facilitator and management team be appointed to manage the program on a day to day basis. This includes a website Administrator. All elements of the program have to be quality assured each step of the way in order to ensure that remedial action is taken timeously, and that the program initiator receives regular progress reports. We believe that selection criteria should be developed and applied to identify and select suitable mentors who will enter the program. Admission cannot be automatic and certain minimum standards have to be adhered to.

There is no clear understanding on how to conduct or define e-mentoring. [6] defines e-mentoring as a process whereby the exchange of information takes place using 75% of computer mediated communication (CMC) technologies. CMC is defined as any communicative transaction which takes place through the use of two or more networked computers [1].

[4] defines e-mentoring as mentoring that can be done without the persons involved in mentoring having to be present in each other’s company. Moreover, they use electronic means such as e-mail, online, interactive web sites, web cam, Skype, sms, or the South African MXit. In other words “there is little or no personal contact and personal communication between the mentor and the mentee” [4].
While the literature mostly refer to e-mentoring done by e-mail [4], in TAMP e-Mentoring is mostly done via the website [7], forum [7], e-mail, facebook [8], and sms. In TAMP’s e-Mentoring the first procedure that a mentee has to follow is to visit and register on TAMP website [9]. Similar to ACM @ UCSB [10], there is no obligation for a mentee to stay in the program. During the registration, the mentee must confirm that he/she has read and understood the TAMP policy. The TAMP policy cover topics such as code of conduct, confidentiality, procedures, cancellation of a session, service termination, complaints procedure, software policies, and liability.

Once registered, the TAMP Administrator will authenticate the mentee. This restriction was incorporated to protect the users of the TAMP website against hackers. It is imperative to guard against unethical and harmful users. A registered mentee will be presented with all the facilities available on the site, which include among others, change of personal details (including change of password), view messages/news, booking a session with a mentor (Figure 1 depicts the process); link to mentors’ blogs (e.g. blog of [11]), and have access to the TAMP Forum [7].

As depicted in Figure 1, a mentee must choose the module on which he/she wishes to be mentored (e.g. TPG11AT – Java Language). The mentee will then be presented with all the mentors in that particular module and the days when the mentors are available for face to face consultation in order to receive feedback.

Once a mentor has been selected, a mentee will be presented with a web page that requests the date, chapter, and topic (e.g. using Strings in Java). The website will then post an e-mail to the booked mentor and inform the mentor of the session specifics. This is to enable the mentor to have enough time to prepare thoroughly for the session and be able to answer all the questions that a mentee may have on the topic. The discussion could also be taken via email and/or TAMP Forum.

The TAMP Forum [7] is mainly used to allow registered users (not necessarily TAMP users as defined above) to post messages on any topic of their choice and make announcements. This platform is similar to what Vuma Portal [12], which was formed in 2007, is doing, except that our users are controlled when registering, and their Internet Protocol (IP) addresses of all posts are monitored. TAMP platform allows mentors and mentees to communicate and have discussions with other users or visitors of the website. The TAMP Administrator regulates these discussions.

On the back-end of the website, the TAMP Administrator can add, edit, delete, search for mentors, mentees, modules, and timetables. The Administrator can also view, analyze, and edit bookings made by mentees. He or she can furthermore post or delete files, surveys, messages, and news.

The TAMP website can also be used to analyze topics such as those listed below.

- What is the pass rate per semester?
- Which topic/module/subject is booked most frequently by mentees?
- Which mentor is booked most frequently?
- Which mentor is most highly rated by mentees?
- How many bookings occur per semester?
- What is the overall pass rate of learners utilizing the mentorship program?

There are numerous disadvantages in using such a tool (i.e. website). For example, the website may not be accessible (see e-mail below from a mentor to the Chairman of TAMP), and also the loss of data (see e-mail from the webmaster of TAMP). The authors of the following e-mails granted us permission to publish them.

**Hey, Mr. Chairman!**

I am having TROUBLE accessing the TAMP website. Is there a problem that side?

I could register on the forum this morning, but since then I haven't been able to browse the website...

Regards,

Diana PHOLO

The developer has indicated that the database was corrupted during the backup process. I was under the impression that he did go to you to explain the situation since he needs to take responsibility for his actions. He did indicate that he went to your office a few times but you were not available. He also indicated that he was willing to do the data capturing for the data that was lost.
The backup process will be looked at to prevent this from happening again.

Aubrey

The TAMP website was developed using PHP. PHP, short for Hypertext Pre-Processor, is a free, open-source server-side scripting language widely used to write dynamic web applications that can interact with databases. Its benefit over JavaScript is that it runs on the web server rather than on the viewer’s personal computer (PC) or Macintosh [13].

We also recommend Moodle (e-Learning system) as another tool that could be used to facilitate e-mentoring[14]. Moodle is an open source tool that can be used as a management tool for any e-mentoring program. Moodle has all the features that are needed to manage a course, and can be modified to incorporate new features such as: tracking a mentee’s progress; uploading sample exercises; uploading progress; and feedback reports by mentors; sharing testimonies by mentees who are ready to become mentors; and many more tasks. It also has a forum and a chat feature.

Whilst e-mentoring has gained popularity in the last decade, we argue, based on our experience in TAMP, that e-mentoring alone is not enough to create an environment of innovation, hence we propose, as we do in the next section, e-mentoring through the Living Lab.

IV. E-MENTORING THROUGH THE LIVING LAB

The idea of a Living Lab first emerged in Europe and later in other continents. The emphasis was on fostering innovation; consequently it was then called the Living Innovation Laboratory. Innovation is an integral component of all development activities since it allows organizations to involve end-users to participate in the development of new service(s). The Living Lab approach offers multi-role and multi-faceted involvement of the customer, who will in turn suggest “innovative ideas, validate the design, and become involved in a dialogue with a producer” [15]. According to [15] this incorporation of the customer into the development process ensures highly consistent market evaluation, reducing technology development costs and business risks.

In the process of implementing the Living Lab approach for mentoring peers, experiences can be gained and shared among learners as students with skills and better understanding in a certain fields can share their knowledge with others in order to empower and create a better future for all. Figure 2 below demonstrates the concept of a Living Lab approach.

The My Mentor Project of the Cape Information Technology Initiative (CITI) started by the Provincial Government of the Western Cape partially attempted the Living Lab approach in 2008 [16]. In their project, participants who were entrepreneurs were required to spend five hours per month dedicated to the program for six months. This included attending monthly sessions with their mentor. The entrepreneurs were also required to attend monthly two hour group sessions, plus social get-togethers with guest speakers (every second month).

The selected entrepreneurs, however, had to be based in the Western Cape and the business had to be significantly focused on ICT enabled; growth-focused; have financial reports; have at least five employees; and have an existing customer base.

In our program we envisage that the following Student Interest Group (SIG) will be formed to be part of the living lab in TAMP (SIG is a formal or informal group of individuals who share similar interests in certain topics or fields) which appear below.)

- Programming SIG – this can further be broken down into specific languages such as C++, C#, Java, etc.
- Networking SIG – this can also be broken down into Wireless, LAN, and Bluetooth.
- Open Source SIG - this group will deal with running and evaluating open source operating systems and related software programs: Ubuntu, Kubuntu, Knoppix, Red Hat, Open Office, etc.
- Robotics SIG – this group can be divided further into device-specific groups such as, the PIC16F group, 8031 chips, Intel Processors-specific groups, Artificial Intelligence groups, Digital Systems (engineering groups, etc.).
- Business Intelligence SIG - this group will focus on issues such as ITIL, IT for Business, Information Systems and so forth. They focus on the business side of IT, including technical support, end-user support, etc.

To make sense of the SIG’s value in learner’s performance, it is necessary for the SIG to run some type
of a semester projects bringing all members to work on a specific project and presenting it during open day or expo events. Regular workshops will also have to be organized. Guest speakers from either other universities or companies will also contribute a great deal to these SIG’s ratings. Each SIG can then be expected to produce a report every semester describing all the events it undertook, and any projects or conferences in which it was involved. Most important is the element of scientific research so that SIG’s can produce articles for accredited journals which will also promote the public image of SIG’s.

V. BENEFITS OF E-MENTORING

We concur with [4] who argues that, even though the traditional mentoring cannot be fully replaced by e-mentoring, it can be “a very effective, speedy and satisfying way of doing mentoring within constraints like not being physically present or available, distance and time”. Over the five year period, since we introduced e-mentoring in TAMP, we have had 14 mentors who have graduated to become Virtual Mentors. Four mentors out of the 14 have since been appointed as Junior Lecturers in the Department of Enterprise Application Development (EAD). The department has also trained and appointed one mentor to administer the TAMP website, mentored by the lecturer who developed the website for the program. These virtual mentors continue to spread the word of e-mentoring in many ways (e.g. [11], [17] and [18]).

Besides the appointments of mentors, we have also noted the improvement of mentees’ marks (grades) in the modules on which they are being mentored on. Even mentors’ marks have improved over this period. The mentors have become experts in their fields and they have advanced their career development. Some mentors, today, are overseas (see e-mail below) improving their careers.

Mr. Facilitator, thank you, I mean thank you for everything! Good luck and God bless. Europe is cold, it feels like my legs are in the refrigerator. Lol

Regards
Agbebiyi

According to Johnson and Ridley (quoted by [4]) e-mentoring is trouble-free between genders where interpersonal contact and the physical presence of the other one is not felt, thus avoiding “romantic/sexual feelings”. In our program the number of females who are mentors is disappointing compared to male mentors. We have had only five women mentors since the inception of the program in 2004. This equates to one female mentor per annum. Clearly this is not enough. Cuny (quoted by [19]) states that the girls have the perception that computer scientists are nerds who spend all day in isolation. Of course this perception is not true. Evans (quoted by [4]) warns that female bosses must study and help women progressing up the ladder to achieve stature.

We also agree with Heynes (quoted by [4]) that the costs of e-mentoring are not high and that the technology is robust and user-friendly, hence mentor and mentee may be connected most of the time (almost everywhere in the world). [4] predicts that e-mentoring will be admired by children since they love technology and use it to the fullest.

VI. CONCLUSION AND THE WAY FORWARD

It is the tradition of all learning processes to have a teacher, a guardian, and a learner. All these are the basic building blocks of learning as both a process and a tool to empower individuals. Matured fields such as scientific and mathematical studies have shown this clearly in the case of Isaac Newton, Albert Einstein, Galileo Galilei and many others.

Our program aims to formalize the previously informal or indirect relationship where mentoring will only take place passively, without any bonding between a guardian and a mentee and without any measure of control or monitoring.

Though we agree with [2] that “there can be no ‘one best way’ in mentoring”, we believe that tools such as the World Wide Web (WWW) and other computer-related utilities (e.g. the TAMP website) would be useful in further enhancing the process of mentorship. This will bridge the gap between skilled, experienced, knowledgeable individuals, and those who can benefit from these collective qualities when shared. We are mindful of what [20] stated “not all mentor programs succeed, and long-standing programs that have been successful can be difficult to access and mine for the lessons they can teach”.

We plan to expand the TAMP Virtual Mentors to TAMP Professional Virtual Mentors, similar to the program of North-West University [4], MentorNet [21], and the IEEE Mentoring Connection [22]. This committee will consist of professional members who are in industry with at least five years industry experience, plus a degree, have regular access to e-mail, and who are willing to spend at least 30 compulsory minutes every week corresponding with a learner. The relationship will be expected to last until a learner graduates.

We believe that the poor performance of learners, including, as is the case in South Africa, poor matriculation results, low pass rates and poor grades for those who do pass, is rooted in the structures of our educational system. Partly this is due to the history of South Africa. There is very little, or no support at all for learners in the learning process, making learning a very
harsh experience for some young people. To drive this point, look at rural schools, where there are few schools, few teachers, and very few educated parents in families. In these communities there is no motivation for learning; they cannot see value in education and as a direct result, learners find themselves wading in a pool of learning alone and unguided.

Our program maintains the tradition of mentoring whilst formalizing the relations between its parties, and incorporating the culture of mentorship into organizations. In this way the full potential of mentorship is realized.

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AUTHORS

Wonga L. Ntshinga is a lecturer and a TAMP Facilitator at the Faculty of ICT with the Tshwane University of Technology. He is also a researcher at SAP Research CEC/UTD, Pretoria, RSA. (e-mail: NtshingaW@tut.ac.za).

Ernest K. Ngassam is a Senior Researcher at SAP Research CEC/UTD, Pretoria, RSA. (e-mail: ernest.ngassam@sap.com).

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