

**PERCEPTIONS OF THE PREPAREDNESS OF PHARMACY GRADUATES FOR
INTERNSHIP RESPONSIBILITIES IN THE INDUSTRIAL PHARMACY**

By

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In accordance with Rule G5.6.3, I hereby declare that the above-mentioned treatise is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

Signature: 

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DEDICATIONS

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ABSTRACT

Pharmacy graduates in South Africa are expected to undertake a compulsory one-year internship in diverse pharmacy settings. These settings include the industrial pharmacy sector, where they are expected to integrate further the knowledge and skills they have acquired during their undergraduate training before entering into the pharmacy profession. The success of graduates during the internship, therefore, depends amongst other things on their perceptions of preparedness. However, the perceptions of South African pharmacy graduates preparedness for the industrial pharmacy setting is not reported in light of the shift in global pharmacy education from product-based to patient-based education which thus provided the impetus for this study.

Semi-structured interviews with individual pharmacy graduates were utilised to explore the perceptions of the preparedness regarding the technical and generic skills required of an industrial pharmacy intern. Inductive data analysis culminated in the development of themes and subthemes.

A lack of preparedness as perceived by graduates was a result of a lack of industrial pharmacy experiential work-based practical training and patient-focused education. Graduates perceived themselves to be fairly prepared with communication and teamwork skills; however, their problem-solving skills were not clear due to the scope of work of an intern pharmacist which hinders them from solving problems. Though graduates expressed that they had acquired adequate theoretical training, the lack of practical application resulted in inadequate technical skills preparedness. Graduates preparedness for the industrial pharmacy can be improved by work-based placements of students in the industry pharmacy setting which will assist students to integrate theory with practice.

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ABBREVIATIONS

BPharm	Bachelor of Pharmacy
CHE	Council on Higher Education
CPD	Continuous Professional Development
DPharm	Doctor of Pharmacy
FIP	International Pharmaceutical Federation
GMP	Good Manufacturing Practices
GPE	Good Pharmacy Educational Standards
HE	Higher Education
NMU	Nelson Mandela University
NQF	National Qualifications Framework
QA	Quality Assurance
QC	Quality Control
SA	South Africa
SAPC	South African Pharmacy Council
SAQA	South African Qualifications Authority
SOP	Standard Operating Procedure
UK	United Kingdom

UNESCO

United Nations Educational, Scientific and Cultural
Organization.

WHO

World Health Organization

DEFINITION OF TERMS

This section defines the key terms used for this research

Generic skills: a general set of skills and attitudes that enables a person to be effective and perform well in a job. These skills can be employed in diverse settings and amongst them is good communication, teamwork, and problem solving.

Pharmacist intern: a pharmacy graduate who is registered with the South African Pharmacy Council in SA and is undertaking a one-year practical training in the workplace supervised by a pharmacist.

Pharmacy graduate: a person who has completed a Bachelor of Pharmacy (BPharm) academic degree.

Preparedness: a state of readiness and willingness to undertake duties at work (Smith, Carpenter, & Fitzpatrick, 2015).

Schools of pharmacy: refers to a department, school or faculty of pharmacy within a higher education institution that provides the BPharm qualification.

Technical skills: abilities and knowledge required for a person to perform a job well.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Pharmacy graduates in South Africa (SA) are required by the South African Pharmacy Council (SAPC) to complete a one-year supervised internship after graduation before they are allowed to register as pharmacists (South African Pharmacy Council, 2017a). During this period of internship, graduates are expected to translate further the knowledge they have acquired during their undergraduate education to work-based practice. Graduates can choose an internship placement either at a hospital pharmacy, community pharmacy, industrial pharmacy or in an academic setting. Furthermore, graduates undertaking internship in an industrial pharmacy or in an academic setting, are further expected to complete an additional 400 hours in a community or hospital pharmacy to acquire skills related to patient care. Throughout the internship period, the pharmacist intern is required to complete an electronic record of Continuing Professional Development (CPD) activities, submit a set of satisfactory supervisors' reports which are reviewed by the SAPC and then undertake and pass the pre-registration examinations.

As mentioned above the internship is considered as a period which provides for the transference of theoretical knowledge and skills taught in the classroom to the workplace and where graduates acquire more work-related skills (Bourdon, Ekeland, & Brion, 2008; Kairuz, Noble, & Shaw, 2010). The success of graduates in the internship settings; therefore, depends amongst other things on the knowledge, technical, and generic skills graduates have acquired previously during their undergraduate training. Employers of graduates also, expect graduates

to be prepared with a range of skills, including communication and teamwork before they undertake an internship so that they can be more productive (Saunders & Zuzel, 2010). Preparedness of graduates, in this case, will reduce the time spent in training new graduates at work and ensure graduates have more fruitful work experiences.

1.2 INTRODUCTION

The primary objective of pharmacy education is to prepare future pharmacists to work independently in all professional pharmacy settings following graduation. Also, pharmacy academic institutions have an immediate goal of preparing graduates for their first jobs as pharmacy interns in a variety of pharmacy internship sites. Preparedness enables a smooth transition to the workplace when graduates have the required skills, discipline-related knowledge, and personal attributes required to function independently at work (Marriott et al., 2008). As a result, pharmacy graduates should, therefore, have the appropriate knowledge and technical skills in line with any pharmacy internship area they will choose. Also, graduates should have the necessary generic skills required to survive and flourish in the workplace, including excellent communication, life-long learning, ability to solve problems, and can work with others (Gall, Bates, & Bruno, 2012).

In light of the above requirements for graduates preparation, the Bachelor of Pharmacy (BPharm) degree in SA and in other parts of the world is a generalist degree and qualifies the graduate to work in diverse professional settings such as industrial pharmacy, community pharmacy, institutional or hospital pharmacy, and academic institutions (Anderson et al., 2009; Atkinson et al., 2014; Sachan, Sachan, & Gangwar, 2012). Furthermore, pharmacy education is more oriented towards patient-care than product-focused (Toklu & Hussain, 2013). This shift towards patient-focused pharmacy education was implemented in order to align pharmacy

education to meeting the global millennium development goals of providing better health to patients. As a result of the generalist and patient-focused nature of the pharmacy degree as mentioned above, some graduates may be well prepared to work in patient-centred pharmacy settings while preparedness in product-oriented sectors such as industrial pharmacy may be minimal. Under-preparedness for a product-focused sector can lead to graduates struggling in the transference of knowledge during their industrial pharmacy internship training.

Graduates undertaking internship in a product-oriented setting of an industrial pharmacy may experience challenges due to minimal preparedness. Some of the challenges that graduates may experience due to unpreparedness as described by other researchers include amongst other things, an inability to translate knowledge into practical skills required by employers and stress (Hannan et al., 2018; Langworthy, 2019; Muthaura, Khamis, Ahmed, & Hussain, 2015). Unpreparedness can be very stressful because graduates expect universities to have equipped them with a range of skills required for survival at work. Also, challenges can be faced by employers when unpreparedness amongst graduates leads to an excessive burden being placed on employers to teach and train graduates (Hodges & Burchell, 2003; Tucker, 2017; Wu-Pong et al., 2013b). The training of unprepared graduates can lead to loss of time and financial resources on the side of employers.

Following the above discussion, in theory, if BPharm graduates are well-prepared with the knowledge, technical and generic skills in all areas of pharmacy, the dissatisfaction, work stress, or shock that first time workers such as interns experience should be less (Gaundan & Mohammadnezhad, 2018; Hannan et al., 2018). However, research has suggested that the focus of pharmacy education in SA is mainly on issues related to patient care with little focus placed on issues related to industrial pharmacy (Boschmans & Kairuz, 2009; James & Cole, 2016;

Malangu, 2014). The patient-centred focus is particularly true when one considers that students complete most of the practical work-based hours during the undergraduate training in community and hospital pharmacy settings (Boschmans & Kairuz, 2009; Malangu, 2014). When most hours are spent on preparing students for patient care in hospital, and retail pharmacies, graduates skills in the area of industrial pharmacy may not be very well developed. In the same way, researchers in other countries have also revealed a shortfall in industrial pharmacy preparation as evidenced by classroom education that is focused mainly on theoretical preparation for hospital and community pharmacy with minimal focus on pharmaceutical sciences, leading to graduates who lack skills in industrial pharmacy (Rantanen & Khinast, 2015; Shah, Besancon, Stolk, Tucker, & Crommelin, 2010). Because of this limited exposure to industrial pharmacy during undergraduate years, graduates may face challenges in transferring knowledge from the classroom to the workplace during an industrial pharmacy internship.

Several studies, both internationally and in SA have determined the preparedness of pharmacy graduates' or students with regard to hospital and community pharmacy, however, only a few international studies have assessed graduates preparedness for industrial pharmacy (Mak, March, Clark, & Gilbert, 2013; McCartney & Boschmans, 2018; Scott, Friesner, & Miller, 2010). Studies exploring graduates preparedness have been used to understand the standard of pharmacy undergraduate education and to determine gaps so that improvements can be made where necessary.

However, a literature search revealed no previously published SA studies which assessed the self-perceived preparedness of pharmacy graduates for internship in the industrial pharmacy, thus providing the impetus for this study. This study, therefore, focused on exploring

pharmacy graduates undertaking internship in industrial pharmacy's perceptions of their preparedness for industrial pharmacy, in terms of their knowledge and skills.

Furthermore, the study seeks to identify graduates perceptions of shortcomings in their competencies during the internship that could be attributed to inadequate prior learning during their university education and to seek advice from graduates on what pharmacy schools can do to overcome these shortcomings.

1.3 PROBLEM STATEMENT

A lack of association by graduates' between information taught in the classroom and what is practiced at work has been highlighted by several studies (Anderson et al., 2011; Billett, 2014; Bukaliya, 2012). Graduates undertaking internship may feel the impact of this when unpreparedness is revealed due to the graduates inability to translate the knowledge they have gained in performing work during internship training (Anisfeld, 2013). Furthermore, due to unpreparedness, graduates may experience several negative emotions such as frustration and confusion, when they are required to perform tasks that they do not understand; which can lead to poor job quality (Milligan, 2016). Also, the company may lose valuable time and incur costs due to the need for additional training and constant supervision of unprepared graduates (Stewart, Wall, & Marciniec, 2016). The unpreparedness experienced by graduates may be due to inadequate theoretical and practical training during their undergraduate years. A literature search revealed no previous research in South Africa which explored whether pharmacy graduates are adequately prepared to competently undertake work in the industrial pharmacy setting, hence the need for this study.

1.4 STUDY AIM AND OBJECTIVES

The primary aim of this study was to gain an understanding of the perceptions of pharmacy graduates regarding their preparedness for work in the industrial pharmacy setting.

In support of this aim, the objectives of this study were to gain an understanding of the perceptions of pharmacist interns in industrial pharmacy setting of their preparedness concerning:

- The technical skills required of intern pharmacists in industrial pharmacy setting.
- The generic skills required of intern pharmacists in industrial pharmacy setting.

1.5 STUDY QUESTION

What are the perceptions of interns employed in the industrial pharmacy setting regarding their preparedness to undertake the job responsibilities required of them?

1.6 TREATISE OVERVIEW

The treatise is presented as follows:

Chapter 1: Introduction: This section highlights the introduction, background, and objectives of this study.

Chapter 2: Literature review: This section provides a broad overview and in-depth discussions of the literature related to this study.

Chapter 3: Methodology: This section discusses the methodological processes employed in this study. Aspects of research design, participants, data collection, and analysis are also highlighted.

Chapter 4: Results and discussion: This section reports the findings of the study. It also discusses the results in line with the existing literature.

Chapter 5: Conclusions limitations and recommendations: This section describes how the study aims and objectives were achieved. It also discusses the limitations of the study and provides recommendations for future practice and research.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter introduced the study, including a highlight of the pharmacy internship and graduates preparation for industrial pharmacy setting. This chapter will discuss in detail the literature in line with this research, particularly as it relates to the role played by institutions of higher education in ensuring that graduates are prepared for their first jobs as interns. Also, the aim of global pharmacy education towards achieving prepared graduates and the steps taken by regulators such as the South African Qualifications Authority (SAQA) and the SAPC in ensuring that SA pharmacy graduates' are suitably prepared will be discussed. Furthermore, the role of industrial pharmacy in the healthcare system will be discussed including highlighting the technical and generic skills that graduates require to be successful in the industrial pharmacy setting and to retain their jobs. The status of graduates skills preparedness internationally and in SA will also be explored.

2.2 HIGHER EDUCATION AND GRADUATES PREPARATION

At the core of every business is an obligation to satisfy and serve its customers accordingly (Fernando, 2009). The Higher Education (HE) sector is regarded as a business serving many customers or stakeholders including, and not limited to, future employers, public, government, and students (Naidoo, Shankar, & Veer, 2011). With an expectation of completing their studies, graduating, and being adequately prepared for future employment, students are also regarded as core stakeholders in HE (Becker et al., 2017; Burrus, Mattern, Naemi, & Roberts, 2017; Guilbault, 2018). Students have this expectation because their success as future

graduates in getting and retaining employment depends, amongst other factors, on whether they are suitably prepared for such jobs. The HE sector is, therefore, expected to prepare graduates with a range of skills and knowledge aligned to their professions to improve their transition to the demanding and fast-paced work environment (Altbach, Reisberg, & Rumbley, 2009). In addition, employers expect universities to produce graduates who are employable and who can demonstrate generic skills including excellent communication, ability to solve problems, function effectively in a team, and manage conflict amongst others in their day to day interactions in the workplace (Brits, 2018; Esa, Arshad, & Mohamad, 2010). Other than the mandate that should be fulfilled by HE in preparing graduates, professional degrees such as pharmacy also have additional objectives that should be fulfilled in preparing graduates for work. The following section will discuss the objectives of pharmacy education in ensuring that graduates possess the necessary skills in preparation for their future professional roles.

2.3 PHARMACY EDUCATION GLOBAL OBJECTIVES

As mentioned in the earlier chapter, pharmacy education is designed to produce skilled pharmacy professionals who can work in diverse pharmacy settings, amongst them; community, hospital, industrial, and academic pharmacy. Furthermore, pharmacy graduates should be able to offer a variety of services concerning their scope of work. Pharmacy education, therefore, aims to produce competent graduates who can produce safe and high-quality medicines for the betterment of the health of patients (Anderson et al., 2009). In addition to acquiring the above skills in preparation for future professional roles, a pharmacy student is also expected to acquire a variety of generic skills such as ability to solve problems, communicate well, work effeciently with others as a member of a team, and be able to undertake research (Donyai, Grant, & Patel, 2017). Therefore, educational strategies in

pharmacy are expected to afford students with the required standard of education and experiences that will allow students to gain the skills as mentioned earlier before graduation and work confidently within most pharmacy-related settings of their choice (Alsharif, 2012).

In order to address the highlighted need for skilled and competent pharmacy workforce who can tackle current and future healthcare needs of the public, the Pharmacy Education Taskforce was formed in 2008 by the following bodies: International Pharmaceutical Federation (FIP), the World Health Organization (WHO), and the United Nations Educational Scientific and Cultural Organization (UNESCO), and UNESCO was charged with the mandate of putting into place an action plan for developing a pharmaceutical workforce with abilities to provide for the healthcare needs of the public (Alsharif, Brennan, Abrons, & Chahine, 2018). The role of the taskforce through the execution of the pharmacy education action plan, also includes overseeing that pharmacy education is structured and implemented globally, locally, and nationally in a manner that will ensure that graduates are prepared with the skills required in their practice settings (Anderson et al., 2009). In addition to the taskforce mandate, the FIP is also committed to improving the delivery of high-quality healthcare by putting in place educational structures and systems that support enforcement of quality education globally (Bader, Bates, Schneider, & Charman, 2017). The points mentioned above highlight the commitment of global pharmacy education stakeholders' endeavour to meet its objective of producing a highly skilled and prepared pharmacy graduates who will be in a position to provide safe medicines to patients.

2.4 OBJECTIVES OF PHARMACY EDUCATION IN SOUTH AFRICA

Pharmacy education in SA aligns itself to the global pharmacy education objectives mentioned in the previous paragraphs and is further aligned to the country's educational and

pharmacy profession objectives. To ensure quality education in SA, the Council on Higher Education (CHE) and the South African Qualification Authority (SAQA) accredits all degree programmes. Both the CHE and SAQA oversee that quality education is achieved in SA qualifications through ensuring that the objectives of the National Qualifications Framework (NQF) are implemented (Council on Higher Education, 2019; South African Qualifications Authority, 2000).

The above-mentioned educational regulatory bodies further work hand in hand with professional bodies like the SAPC where necessary to ensure that SA pharmacy education meets the required educational standards. One of the aims of the SAPC is to oversee both the practice and education of pharmacists in SA and the SAPC is responsible for ensuring, through monitoring of pharmacy education, that pharmacy graduates are prepared with skills that will allow them to practice across all sectors of pharmacy (South African Pharmacy Council, 2014). To achieve the above goal, the SAPC in consultation with national and international pharmacy stakeholders established the Good Pharmacy Education Standards (GPE) as guidance aimed at schools of pharmacy to use in the provision of quality education to guarantee that pharmacy graduates are furnished with the right knowledge and skills to perform the pharmacist roles they are being prepared to fulfil in the future (South African Pharmacy Council, 2014). Furthermore, as a result of the changing role of pharmacists and identified gaps in the competency standards used in SA, the SAPC was prompted to revise the professional competences to fulfil the expectations of industry and to ensure public safety (South African Pharmacy Council, 2017b, 2018b). The competency standards can be used to assess if pharmacy graduates have the required knowledge and abilities to work in the industrial pharmacy.

To achieve the mission of having well-prepared pharmacy graduates, the SAPC holds regular meetings and periodically visits academic institutions to monitor the adherence of schools of pharmacy to the set standards as reflected in the GPE guidelines. The SAPC also encourages collaboration of all stakeholders including industry employers and the higher education sector towards the preparation of a future pharmacist who can contribute towards the provision of high quality and safe healthcare including medicines (South African Pharmacy Council, 2017b).

2.5 ROLE OF INDUSTRIAL PHARMACY IN HEALTHCARE

At the core of health professional education is the quest to ensure that patients receive the best healthcare (Lowenstein, Foord-May, & Romano, 2009). Patients expect medicines to cure and/or prevent their illnesses, be safe and effective and to be of high quality (Dohnhammar, Reeve, & Walley, 2016). For this reason, pharmacy and other professionals in industrial pharmacy strive to meet the aforementioned expectations through producing high-quality medicines needed to treat a variety of illnesses (Saleh, Rezk, Laika, Ali, & El-Metwally, 2015). Also, the role of pharmacists and other scientific professionals in industrial pharmacy extend beyond manufacturing to continuous discovery of medicines in order to treat newly emerging diseases which necessitate more efforts to be placed on research and development (Durrant, 2001). Consequently, pharmacy education should strive to produce graduates who are highly skilled and have the necessary technical skills required for industrial pharmacy so that they can contribute positively in the discovery and production of safe and high-quality medicines required to treat diseases (Bader et al., 2017). The next sections will discuss the required technical and generic skills that graduates must be prepared with in order to be successful interns in the industrial pharmacy setting.

2.6 TECHNICAL SKILLS REQUIRED OF AN INDUSTRIAL PHARMACIST

Technical competencies or skills are the abilities and knowledge needed to perform a job and can be used as a base to judge whether or not graduates can carry out tasks related to their career (Yang, Fang, & Huang, 2017). As a result, pharmacy education and other health professions are characterised by distinct competencies that are used to define the outcomes of students' learning (Kairuz et al., 2010; Muthaura et al., 2015; Talberg & Scott, 2014). These outcomes of learning are also used to guide educators in designing teaching strategies which will maximise students' acquisition of such skills. Technical skills also, therefore, form the basis for the assessment of graduates preparedness to perform tasks associated with the profession by employers and regulators (Yang et al., 2017). As a result of the importance of technical skills in job performance, it is essential for pharmacy educators to ensure that teaching strategies are implemented through proven methods that aid students to acquire the knowledge and attain skills through engagement in classroom and work-based training activities which hone such skills. Since experience is regarded as the best teacher, work-based training incorporated through work-based training is essential in order to sharpen students skills through practice at work (di Gropello, 2011).

In the industrial pharmacy sector, graduates are expected to have technical skills in the following major functional areas: medicines research and development, medicines manufacturing, and quality control and assurance amongst others (Gmeiner et al., 2017; Saleh et al., 2015; Sam & Parasuraman, 2015). Other areas in industrial pharmacy in which pharmacists should be skilled include pharmacovigilance, regulatory affairs and medicines marketing amongst others. The significant functions under which industrial pharmacist should be skilled will be discussed further in the subsequent sections.

2.6.1 Medicines research and development

Industrial pharmacists, together with other scientists, engage in research and development activities towards the discovery of novel medicines to treat current and emerging diseases (Chanakit, Low, Wongpoowarak, Moolasarn, & Anderson, 2014). During medicines discovery, pharmacists' work as part of multidisciplinary teams and are involved in intensive, lengthy, and budget consuming research towards the identification of potential lead compounds which will further be developed into new medicine formulations (Petrova, 2014). Once the potential lead compound is confirmed to have a physiological action, the development phase follows in which the lead compound is converted into a medicine through a series of studies which aim to establish safety and efficacy data to be used in product approval applications (Chen et al., 2018).

Furthermore, engagement in research is essential in industrial pharmacy as companies would have increased chances of success and sustainability if new products can be produced continuously and the company can remain competitive in the business world (Ahn, Park, & Woo, 2017; Islam, Rahman, & Al Mahmood, 2018). For that reason, the engagement of skilled pharmacy graduates in research activities will enable new products to be discovered and developed. Amongst the research skills that pharmacy graduates should have to thrive in research towards medicines discovery and development include the ability to critically appraise and analyse literature, writing skills, and research publication skills (Chibale, Davies-Coleman, & Masimirembwa, 2012). At the same time, due to the team approach nature of discovery and development research projects, graduates should also have skills to manage projects, manage time, communicate effectively, and be able to solve problems that may arise during the project cycle (Stonier, 2003).

However, recent reports have highlighted a shortage of skilled persons in industrial pharmacy research and development as a result of inadequate research training of students and the clinical focus of pharmacy education at the expense of the pharmaceutical sciences (Mooney, 2001; Shah et al., 2010; Wuliji et al., 2011). In light to the above deficiencies seen in pharmacy graduates, pharmacy education should, therefore, develop curricula and educational strategies that will equip students with skills to be part of teams that can contribute positively in the discovery of new medicines through research (Vizirianakis, 2002). One way that educators can improve students research skills is through assigning work that will require students to conduct their research on the internet, thereby gather information shared in accredited journal articles and books (Alismail & McGuire, 2015). Using the internet, students will learn how to organise a variety of literature gathered and critically appraise it to understand the concepts. Students also develop reading and writing skills which can help in fine-tuning the skills required in sharing their findings within the academic world.

2.6.2 Medicine manufacturing

Medicines manufacturing is a process that involves converting a drug substance into a quality medicinal product in large industrial quantities under the principles of good manufacturing practices (GMP) (Boehncke & Radeke, 2007). GMP guidelines in medicines manufacturing ensure that quality is built into the medicine and minimises errors due to contamination which can affect the overall quality and ultimately the safety and efficacy of the medicinal product (Nally, 2016). To ensure that medicine products meet quality requirements, pharmacists' are responsible for the manufacture of medicines as supervisors of the production process. Pharmacists' role involve, certifying that the process is carried out in line with the batch manufacturing records and making sure that subordinates follow company guidelines to

ensure conformance to the set standards (Gad, 2008; Pereira & Trotter, 2017). In order to effectively carry out this role of supervision, pharmacists should demonstrate interpersonal skills such as; being friendly, easy to talk to, open to new ideas, show appreciation, and support to their subordinates (Pereira & Trotter, 2017). Also, the supervisors should have excellent communication skills, be able to ask open-ended questions in order to get more clarity from subordinates and be able to solve problems that arise during work.

During manufacturing, a multi-step process comprising of several unit operations is followed including assembly of approved ingredients in the dispensary, actual production according to batch manufacturing instructions, approval of final product, and packaging. Skills such as time management, ability to perform calculations and machinery knowledge are therefore required, to meet manufacturing requirements as highlighted above (FitzSimons, 2000; Potdar, 2006). Additional technical skills in the implementation of GMP guidelines include the ability to understand the use of a variety of documents such as Standard Operating Procedures (SOPs) and ensure that documents are completed and well stored so that a traceable history of the product is available.

Atkinson et al. (2016) conducted a study assessing the necessary competencies required for practice in the industrial pharmacy, in which results highlight that ability to manufacture medicines was classified as a crucial skill. Moreover, in Europe, employers working in industrial pharmacy anticipate hiring pharmacy graduates with combined knowledge and technical abilities of ingredients used in the manufacture of medicines, including the ability to manufacture medicines and test their quality (Davies, 2017). Knowledge about ingredients used in the manufacture of products and testing of quality are essential in ensuring that the final product manufactured is of the right quality.

2.6.3 Medicines quality control

Pharmacists in industrial pharmacy are also expected to have skills in the supervision of medicines Quality Control (QC). QC works hand in hand with the quality assurance (QA) department for testing, sampling, setting of specifications and release of a product to certify that the final pharmaceutical product meets the quality criteria and patients expectations (Lambert, 2014; Troy, Remington, & Beringer, 2006). Pharmaceutical QC, therefore, ensures that the medicine manufactured is of good quality and meets the set quality standards. The role of a pharmacist in QC, therefore, is to supervise the testing, sampling, and release of product (Lambert, 2014). To carry out the QC role required of them, pharmacists should be equipped with skills to supervise procedures, critically analyse data, be observant and be able to solve problems amongst other skills (Nally, 2016).

2.6.4 Medicines quality assurance

In addition to quality control, pharmaceutical quality assurance serves as the overall enforcer of quality in an industrial pharmacy (Nagori, Gaur, Solanki, & Mathur, 2018). QA, therefore, ensures that quality is maintained by all the departments in the pharmaceutical industry. Hence, pharmacists responsible for quality assurance activities must have management skills, project and time management skills, and leadership skills (Potdar, 2006). Also, due to the extensive regulation associated with the pharmaceutical industry, quality assurance pharmacists should have excellent documentation skills which will assist during product audits and approvals.

2.7 GRADUATE PREPAREDNESS FOR INDUSTRIAL PHARMACY IN THE INTERNATIONAL CONTEXT

Graduate preparedness for industrial pharmacy work-related aspects of practice is generally an under-researched area as compared to graduate preparedness for hospital and community pharmacy settings. International literature reports little on graduates preparedness for industrial pharmacy setting. A survey-based study in Saudi Arabia determining the willingness of pharmacy students in their last year of BPharm and Doctor of Pharmacy (DPharm) degrees to pursue job opportunities in the industrial pharmacy setting revealed a low desire to pursue job opportunities in industrial pharmacy due to a lack of work-based practical training during their undergraduate education (Saleh et al., 2015). Most students in the Saudi study revealed that they did not have the necessary skills to work in the pharmaceutical industry setting and were therefore not prepared to work there. Lack of work-based practical experiences could have affected students confidence in their technical abilities to perform tasks leading them to avoid careers related to industrial pharmacy sector.

Furthermore, Refai and Thompson (2015) conducted a study in the United Kingdom (UK), by utilising qualitative interviews to determine if pharmacy graduates after completion of a four year Masters of Pharmacy (MPharm) had the necessary enterprise skills. Results of the above study revealed that industrial pharmacy employers felt that graduates were not competent to carry out tasks requested of them in the industrial pharmacy workplace. Employers in the Refai and Thompson study felt that the lack of skills amongst graduates was a result of pharmacy education being too clinically focused with minimal focus on courses that prepared students for industrial pharmacy sector.

A further study conducted a mixed-methods research to determine the career intentions of pharmacy students in Australia and revealed that only a minimal number of pharmacy students were willing to pursue jobs in industrial pharmacy due to poor understanding of the role of pharmacists in industrial pharmacy sector (Shen, Fois, Nissen, & Saini, 2014). Students in the above study had previously been exposed to work-based training in community pharmacy (100%), hospital pharmacy (66%), and a minority of the students (22.7%) had exposure in industrial pharmacy setting. This minimal exposure in industrial pharmacy work-based training could have impacted on their confidence to undertake duties associated with industrial pharmacy setting.

By contrast, pharmacy education in India is pharmaceutical industry-focused (Basak & Sathyanarayana, 2010; Sachan et al., 2012); however, graduates are still considered not to have adequate technical skills to start work as industrial pharmacists (Ackerhans, 2016; Basak & Sathyanarayana, 2010). The lack of skills was attributed to an old curriculum that has not been reviewed and minimal practical training of students (Ackerhans, 2016).

Similarly, in Kenya, a lack of skilled professionals in industrial pharmacy sector primarily related to manufacturing and quality assurance activities has been highlighted (Abduelkarem, 2014). The skills shortage was attributed to clinically-focused pharmacy education with minimal attention to industrial pharmacy preparation. Managers in the Kenyan study claimed that the skills shortage led to their companies incurring costs of hiring external experts to train pharmacy graduates to acquire industrial pharmacy-related skills. Moreover, Tanzania is also reported to have a shortage of skilled professionals to work in industrial pharmacy which has also led to companies losing valuable time in training people to acquire

necessary skills (Abduelkarem, 2014; Mackintosh, Tibandebage, Kungu, Njeru, & Israel, 2016).

The unpreparedness of graduates revealed in these studies lead to an inconsistency between the expectations of industrial pharmacy employers from what graduates can offer. The closure of the gap mentioned above through collaboration between universities and the industrial pharmacy stakeholders is essential (Mooney, 2001). The collaboration will provide an opportunity for industrial pharmacy to bring their expectations of graduates to the fore, allowing schools of pharmacy to align educational activities with industrial pharmacy expectations.

From the above discussions, it can be deduced that many pharmacy graduates internationally are not prepared for industrial pharmacy related work due to a lack of adequate industrial pharmacy exposure during their undergraduate education.

2.8 TECHNICAL SKILLS PREPAREDNESS FOR INDUSTRIAL PHARMACY IN SOUTH AFRICA

In SA, there is limited literature shared on the status of pharmacy graduates preparedness for industrial pharmacy setting. However, one study utilising a survey to assess if pharmacy graduates working in industrial pharmacy were competent to carry out their roles in regulatory affairs, revealed that pharmacy graduates were not prepared for regulatory affairs related work (Moonsamy, 2016). The lack of preparedness was attributed to minimal content related to industrial pharmacy being taught during the undergraduate education and minimal collaboration between industry and academic institutions.

In addition, a study analysing pharmaceutical production in SA revealed a shortage of pharmacists skills in manufacturing due to pharmacy education which tends to train students to be community pharmacists (Luiz & Naude, 2013). The employers in the study also revealed that due to a lack of skilled pharmacy graduates, the companies end up incurring costs of hiring other skilled persons from abroad to conduct in-house training of pharmacists.

Moreover, graduates of one SA pharmacy school from a study determining the work distribution amongst its graduates recommended integration of industrial pharmacy work-based training during undergraduate training to increase preparedness of graduates who want to pursue careers in industrial pharmacy (Dambisya, Modipa, & Legodi, 2005). This recommendation implied that some graduates in industrial pharmacy were not adequately prepared for work due to a lack of work-based training during undergraduate education. The studies above highlight a lack of preparedness for some aspects of industrial pharmacy in SA.

2.9 GENERIC SKILLS REQUIRED IN THE INDUSTRIAL PHARMACY SECTOR

In addition to technical skills required for industrial pharmacy, pharmacy graduates also require a variety of generic skills that would prepare them to work as skilled professionals in the future (Rodzalan & Saat, 2012; Wu-Pong et al., 2013a). Generic or soft skills are a set of characteristics in an individual graduate that employers seek and expect the university to have embedded in a graduate (Chetty, Coetzee, Botha, & Eccles, 2012; Wickramasinghe & Perera, 2010). Generic skills are also defined by Esa et al. (2010) as the skills necessary for graduates to get and retain jobs since graduates who demonstrate these skills are more likely to be employed. As highlighted in the preceding statement, employers are seeking graduates who possess not only a graduate certificate but also necessary generic skills such as excellent communication, ability to function effectively with others in a team, ability to solve any

challenges and problems that arise and the ability to engage in continuous learning amongst other skills (Rodzalan & Saat, 2012).

Moreover, students are equally hoping for universities to equip them with the necessary generic skills before they leave universities (Esa et al., 2010). Nevertheless, though universities are mandated to ensure that graduates attain the necessary generic skills before graduation, students should also self-assess the generic skills that they have acquired and to put improvement strategies for those generic skills they are deficient with (Su, 2014). The focal point of generic skills necessary for graduate success in the industrial pharmacy context include the ability to communicate with other scientists, multidisciplinary teamwork skills and problem-solving amongst others (Triggle & Miller, 1999; Wu-Pong et al., 2013b). These skills will be discussed in detail in the next sections.

2.9.1 Communication skills

Communication is one of the essential generic skills that pharmacy professionals practising across a variety of pharmacy sectors must possess (O'Brien, Flowers, & Stowe, 2017). Communication is the process that involves the interchange of information between two or more people where one acts as the sender and others receivers through speaking, writing, or non-verbal means (Beardsley, Kimberlin, & Tindall, 2012; Sporrang & Kaae, 2019). Communication skills are vital for a pharmacist despite the area of practice, whether working directly within a healthcare team or with other scientific professionals in the industrial pharmacy. Therefore, it is crucial for pharmacy students to acquire excellent communication skills such as: being a good listener, demonstrate respect for others and have good writing skills before they leave universities (McDonough & Bennett, 2006; McLaughlin et al., 2019).

Thus, schools of pharmacy are encouraged to incorporate activities in the curriculum that would cultivate in students the acquisition of good communication skills before students leave university (South African Pharmacy Council, 2018b; Stupans, Atkinson, Meštrović, Nash, & Rouse, 2016; Wallman, Vaudan, & Sporrang, 2013). One strategy that educators can use to develop students communication skills is by placing them into groups and giving them theoretical problems to solve and submit as a written document (Katajavuori et al., 2017). The interactions in such group activities will help students acquire skills related to written and verbal communication while at the same time being able to be good listeners. Pharmacy graduates as future industrial pharmacists' should be equipped with abilities to communicate well with others as this ability will assist them in having effective interactions with co-workers and other team members which ultimately leads to building quality into the medicines production (Rodzalan & Saat, 2012).

Moreover, amid increasing unemployment rates globally, pharmacy graduates who have excellent communication skills are expected to have a higher chance than their counterparts of getting employment; since employers of pharmacy graduates expect them to communicate effectively with others at work and convey clear messages to their listeners (Mucalo et al., 2016).

Atkinson et al. (2016) investigated the competencies that are crucial for industrial pharmacy, and clear communication skills were ranked as an important competency which can minimise quality mistakes caused by weak and unclear communication. Therefore, pharmacy graduates despite the area of practice in which they are engaged, are expected to communicate well with others so that ultimately the best patient outcomes can be achieved (Pharmine Pharmacy Education in Europe, 2011).

2.9.2 Teamwork skills

Teamwork skills enable a person to view ideas from other peoples' perspectives and generate team solutions when day to day problems arise at work (Sonnenschein, Barker, & Hibbins, 2017). Graduates across all disciplines are expected to have skills to interact with others at work. Also, the ability for graduates to function well in teams which involve people of different cultures and personal characteristics is highly desired by employers (Bennett, Pitt, & Price, 2012). The ability of graduates to function in teams in SA will likely be most desirable considering the multicultural nations in SA.

Moreover, ability to function in teams composed of a variety of scientific professionals is essential among pharmacists in industry as their daily work requires close collaboration with other scientific colleagues, including amongst others, chemists, engineers, clinicians, and biologists. Pharmacists and scientific colleagues in teams highlighted above, share knowledge, experiences, and skills in solving day to day challenges toward meeting quality objectives (Nancarrow et al., 2013). Also, due to the importance of teamwork skills in industrial pharmacy for consistent productivity, employers look for graduates who possess these skills (McLaughlin et al., 2019). To function efficiently in a team, pharmacy graduates should, therefore, have the following specific skills: excellent communication, ability to listen to others, commitment to team goals and be able to get along with others (Lingard, 2010; Morgeson, Reider, & Campion, 2005).

Therefore, being equipped with teamwork skills will enable graduates undertaking internship to have fruitful collaborative work and exchange of ideas with other team members. Furthermore, the development of teamwork skills for an industrial pharmacist is crucial as it

allows graduates to nurture other generic skills such as confidence, conflict management, and communication skills (Brock, Loewy, & Loh, 2017).

2.9.3 Problem-solving skills

Problem-solving skills enable a person to come up with solutions for problems or challenges encountered during daily life. To solve a problem, one should critically evaluate what caused the problem and come up with strategies for solving that problem (Greiff, Holt, & Funke, 2013). Being able to solve problems that arise during day to day activities and coming up with functional solutions will allow pharmacy graduates to contribute in the success of the companies where they are hired (Martin, Donohoe, & Holdford, 2016).

In addition, the ability to solve problems for new pharmacy graduates is regarded as an essential skill for employability, as the industrial pharmacy sector constantly deals with challenging quality issues, and therefore, employers would be more interested in graduates who are able to evaluate problems and come up with strategies to solve those challenges (Oderda et al., 2010). Also, due to the quality challenges highlighted above, industrial pharmacy employers have pinpointed the need for graduates who can solve problems on their own while at the same time knowing when to seek help (McLaughlin et al., 2019). The ability to seek help will ensure that graduates still work within their scope of work. To come up with solutions in solving work-related problems in an efficient and timely manner, graduates should be equipped with information collection skills, critically evaluate the information to determine problem causes and plan solutions (Taylor, Lashman, & Helling, 1994). Additionally, graduates should have confidence and excellent communication skills in order to effectively share their plan of solutions to others in a transparent manner. Gathering data promptly and executing solutions

is essential, as business time will be lost during the time between when a problem occurs until it is solved.

2.10 GENERIC SKILLS PREPAREDNESS AMONGST PHARMACY GRADUATES IN THE INTERNATIONAL CONTEXT

In this section, studies exploring pharmacy graduates status of generic skills preparedness across different parts of the world will be discussed. However, most of these studies have determined the generic skills preparedness of graduates' for community pharmacy and hospital pharmacy. Nevertheless, since generic skills cut across all sectors of pharmacy (Bader et al., 2017), it will be assumed that the generic skills that can be demonstrated in one pharmacy setting can be applied in the other settings; therefore, those studies have relevance in the industrial pharmacy context too unless otherwise indicated.

A New Zealand study utilising a questionnaire to determine whether BPharm graduates undertaking internship training in a community and hospital settings were prepared to undertake job responsibilities revealed that preceptors felt that although graduates were prepared in other areas, they lacked effective communication skills and were too arrogant (Kairuz et al., 2010). On the other hand, graduates in the same study felt that they had effective communication skills. The difference in preparedness perceptions in this study could be due to graduates arrogance as highlighted by their supervisors. Supervisors in this study felt that graduates were arrogant in a sense of believing they knew all the matters related to pharmacy such that new information coming from preceptors was of little importance.

In addition, a UK based study assessing professionalism amongst pharmacy graduates in an internship revealed that tutors felt that graduates were not able to communicate well with other team members (Christou & Wright, 2011). The study further recommended that

pharmacy education should prepare students' for internship by focusing on students' attainment of skills to communicate effectively. By contrast, self-assessment by students and graduates in other studies revealed that students felt better prepared with generic skills like communication (Mort & Hansen, 2010; O'Brien, Flowers, & Stowe, 2015). On the other hand, pharmaceutical industry employers in one study have revealed that graduates lacked written communication skills which could decrease their chances of getting employment (McLaughlin et al., 2019).

Furthermore, an Australian study utilised qualitative interviews to determine pharmacy graduates preparedness for work and found that, although graduates were well prepared for work, they somewhat lacked generic skills including an ability to manage work relations (Stupans, 2012). Work relations or teamwork skills as previously discussed enable one to have respect for others and solve any challenges from other team members' perspective, which in turn, will ensure graduates acquire greater knowledge. A recent study evaluating the skills required for graduates in industrial pharmacy also revealed that employers need graduates who understand their role and function well within a team (McLaughlin et al., 2019). One study conducted in Sierra Leone utilised questionnaires to assess the perceived preparedness of pharmacy interns for practice and revealed that only half of the interns were prepared to function as members of a clinical team (James & Cole, 2016). The low preparedness to work as part of a diverse clinical team can imply that intern pharmacists in the abovementioned study will face difficulty in interacting with colleagues and forming successful teams in the workplace.

The discussions from the above studies reveal that though most pharmacy graduates are prepared to start work, they still lack some of the generic skills required for success at work.

The implication of this is that there is a need for exposure and practical opportunities for acquiring generic skills during pharmacy education to ensure that graduates can be professional and competitive at work.

2.11 GENERIC SKILLS PREPAREDNESS AMONG PHARMACY GRADUATES SA

In SA, the SAPC emphasises the importance of generic skills among pharmacists and pharmacy graduates to enable them to be ready to meet the requirements of the fast-evolving profession. With reference to the above, the competency standards for pharmacists were developed by the SAPC as guidance for schools of pharmacy to use during the undergraduate training of future pharmacists to prepare them with the right attitudes for carrying out their professional duties (South African Pharmacy Council, 2018a). A review of the SA competency standards for pharmacists and other published literature suggests that the curriculum for schools of pharmacy should provide opportunities for pharmacy students to cultivate generic skills including; effective communication, teamwork and collaborative skills, ability to engage in research, and solve problems (Jungnickel, Kelley, Hammer, Haines, & Marlowe, 2009; South African Pharmacy Council, 2018a).

A literature search revealed only a few studies assessing the status of generic skills preparedness amongst SA pharmacy students or graduates. The results of a study conducted among pharmacy final year students from one SA university, revealed that students felt that they had good teamwork and communication abilities, that they were able to provide meaningful and respectful feedback to their colleagues, and were able to solve problems after being introduced to a team-based learning strategy to help them develop these skills (Eksteen, 2019). Working in teams may have stimulated students to develop the mentioned skills through

close interactions amongst team members. This study reveals the importance of designing curricular activities that enhance students acquisition of necessary generic skills needed in the pharmacy profession.

In a study exploring students experiences during an experiential work-based learning program, several students expressed an initial limited confidence in approaching patients to start communication (McCartney & Boschmans, 2018). After the work-based training programme, students in the above study reported an improvement in their ability to communicate with others effectively. This study demonstrated the crucial role played by work-based practical training towards nurturing generic skills amongst students.

2.12 SUMMARY

The current chapter discussed the literature review concerning the role played by higher education, global bodies governing pharmacy education and the SAPC towards preparing SA pharmacy graduates for professional practice. Also, students and employers' expectations from universities of having graduates who are prepared for future work and professional lives were discussed. An overview of the requirements for students' preparedness for work-based aspects related to industrial pharmacy in terms of ability to translate knowledge in the performance of work through having the necessary technical skills related to industrial pharmacy was provided. Also, aspects of graduates' preparedness through demonstration of the necessary generic skills such as the ability to communicate with others, function as part of a team, and be able to solve problems at work were highlighted.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter highlights the research methodology and design that were utilised in the current study to provide an initial exploration of the perceptions of preparedness of pharmacy graduates for industrial pharmacy. The researcher, therefore, utilised a qualitative method of enquiry to answer the research question and objectives and gain an initial understanding and clarity of how pharmacy graduates perceived their preparedness to carry out tasks assigned to them. Qualitative research aims to understand how people affected by a phenomenon under study view their experiences and the meaning they give to those encounters (Merriam & Tisdell, 2016). During qualitative research, participants describe in detail through interviews or focus groups for example, how they perceive their experiences to have shaped the way they view the research phenomenon being explored (Alfehaid, Qotineh, Alsuhebany, Alharbi, & Almodaimegh, 2018; Holloway & Wheeler, 2013).

Qualitative research was, therefore, suitable in this study in order to get a clear picture of how pharmacy graduates perceive their preparedness to start work in the industrial pharmacy. Qualitative interviews, therefore, allowed the researcher to inquire deeply through discussions with pharmacy graduates how they perceived their undergraduate education to have equipped them with skills for fulfilling their roles in the industrial pharmacy.

3.2 RESEARCH DESIGN

To understand and explore the perceptions of preparedness for industrial pharmacy among pharmacy graduates, an explorative research design was utilised in this research.

According to Stebbins (2001), exploratory research aims to acquire more clarity of the problem being reviewed by the study and is suitable for research problems where minimal research has previously been conducted. Exploratory research was, therefore, suitable for this study since it allowed the researcher to gain more understanding of the perceptions of preparedness for industrial pharmacy amongst pharmacy graduates. An explorative research was suitable in this research because there are few published studies on preparedness of pharmacy graduates to undertake work responsibilities in an industrial pharmacy setting and therefore, requiring a method that would investigate the study question in an explorative manner.

A qualitative study was employed to gain clarity on the perceptions of preparedness of pharmacy graduates during the internship period in the industrial pharmacy, and semi-structured interviews were employed to get a more in-depth understanding of their perceptions (Clifford, Cope, Gillespie, & French, 2016).

3.3 RESEARCH SITE

The research focused on the self-perceived preparedness of pharmacy graduates undertaking internship in the industrial pharmacy. The research data was initially collected in one industrial pharmacy based in Johannesburg offering internship to BPharm graduates. The study participants in this study site referred the researcher to other interns working in another industrial pharmacy in Johannesburg. The participant working in the other industrial pharmacy then chose a location in a quiet restaurant mall in Johannesburg, where the interview was conducted.

3.4 RESEARCH POPULATION

The population in the current study included pharmacy graduates with a four-year BPharm degree attained from an SA university, who were completing an internship in the industrial pharmacy setting.

3.5 SAMPLE SELECTION

A clear description of the sampling procedures utilised in selecting the participants is essential in any research to allow readers to get clarity of the research process. Sampling procedures are also necessary for any research since obtaining data from the entire eligible population is impossible due to time constraints and limited financial resources (Gentles, Charles, Ploeg, & McKibbon, 2015). A non-probability sampling technique called purposive sampling was utilised in the selection of pharmacy graduates undertaking internship in an industrial pharmacy setting who met the specifications defined in the eligibility criteria (Elbardan & Kholeif, 2017). The eligibility criteria for adding participants in the study included being a pharmacy graduate with a four years bachelor's degree attained at any registered School of Pharmacy at a University in SA, and registered with the SAPC as a pharmacy intern for not less than three months, and undertaking internship training in the industrial pharmacy setting that is registered with the SAPC to carry out manufacturing of generic medicines.

Non-probability sampling technique aims to select participants according to their relevance to the research phenomenon being explored to acquire a deeper clarity (Babbie, 2010; Daniel, 2011). Moreover, non-probability purposive sampling technique enables the researcher to select participants based on their experiences which are related to the research problem being explored and on their willingness to share such information (Daniel, 2011). Therefore, purposive sampling was ideal in the selection of pharmacy graduates undertaking an internship

in industrial pharmacy sector since they had necessary experiences, and they were able to elicit their perceptions of preparedness to undertake tasks assigned to them. For this research, four pharmacy graduates completing internship training in an industrial pharmacy sector were chosen (Etikan, Musa, & Alkassim, 2016). Though this number is very small as compared to samples used by other qualitative authors of up to twelve participants, research has also demonstrated that the small sample of up to four participants can provide rich, informative data that can answer the research question and aims (Romney, Weller, & Batchelder, 1986). Therefore, to ensure that rich quality information was acquired from the participants, the researcher used the recommendations of Malterud, Siersma, & Guassora (2016) through ensuring that the research aim was specific and narrow and by clearly defining the characteristics of the sample as outlined in the eligibility criteria. A concise and narrow research aim allowed the researcher to concentrate on exploring only the aspects that answered the objective and specific characteristics of sample ensured that participants are suitable to help in answering the research question. The research sample in this study came from three of the nine schools of pharmacy in SA universities being University of Witwatersrand, North-West University, and Tswane University of Technology.

3.5.1 Participants recruitment procedure

The researcher experienced many difficulties in trying to recruit participants to take part in the study due to a limited number interns' in industrial pharmacy setting in SA and the fact that the interns' managers can only grant access to interns. Firstly, the researcher sent letters of request (Appendix B) to the interns' managers in different industrial pharmacy companies to be allowed access to interview interns at the plants. However, when no response was given despite follow-up emails, the researcher then called the interns managers.

Only one intern manager from one company agreed to grant the researcher access to interview interns; however, despite constant follow-up emails and phone calls reminding the manager to grant permission, it was not given. Instead, a verbal claim that the company management had not granted permission was provided to the researcher. The researcher then requested assistance from her former classmates in the MPharm Industrial Pharmacy program at the Nelson Mandela University working as industrial pharmacists to assist recruiting the pharmacy interns in the companies in which they work. However, only one industrial pharmacist assisted the researcher in getting access to the interns. Other former classmates suggested that recruiting interns would compromise their jobs as they are not allowed to talk with interns regarding issues of research.

The industrial pharmacist who had agreed to assist in recruiting interns, introduced the purpose of the study to the interns around June 2019. The interns interested in participating in the study then offered their contact numbers for the researcher to follow-up. The researcher contacted the participants and requested their email addresses followed by emailing the approved intern pharmacist recruitment letter from the Nelson Mandela University (see Appendix C) explaining the research objectives and procedure to the interns. The interns collectively with the researcher set a date for the interviews which took place at the industrial pharmacy plant in Johannesburg.

For further interviews, the researcher used referrals from the first participants to reach the next participants as several attempts to reach interns working in different industrial pharmacies had failed. Consequently, the researcher was given the contact numbers of three other interns working in one other industrial pharmacy in Johannesburg, and after contacting them, she introduced the research purpose to them by phone and requested their email addresses

and sent them the intern pharmacist recruitment letter (Appendix C). Only one intern agreed to take part in the study and the date for the last interview was set and carried out in November 2019. The location was a mall in Johannesburg chosen by the participant due to its close vicinity to the work environment.

3.6 DATA COLLECTION TOOL AND PROCEDURE

The researcher utilised face-to-face semi-structured interviews and the interns were asked to provide a narrative of their perceptions of preparedness to practice in the industrial pharmacy sector. The interviews were conducted in English, which allowed the researcher to gather information from the participants in a language that both parties were conversant with.

During the interviews, participants were encouraged to provide an account of their experiences concerning perceptions of preparedness for the work they are expected to perform in the industrial pharmacy. The researcher was flexible in gathering information related to perceptions of preparedness from interns by allowing the participants to relate their experiences in a non-rigid order (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). However, the researcher ensured that all the questions outlined in the interview guide (Appendix E) were asked together with probing questions where necessary to get more answers from participants. The interview guide composed mainly of open-ended questions and a minority of close-ended questions (Doody & Noonan, 2013). The open-ended section of the interview guide allowed the researcher to acquire information on self-perceived preparedness amongst pharmacy graduates. Before the interview commenced with the individual participant, the researcher reintroduced the purpose of the study as reflected in the intern pharmacist recruitment letter (Appendix C) after which, each participant was requested to sign a consent form (Appendix D). After signing the consent forms, each participant was then handed the first part of the interview guide which

comprised of closed-ended questions about the job functions that interns are expected to perform during the internship (Appendix E). In this first part, interns had to tick the job functions that they are currently doing in the internship site. The job functions were extracted from the SA intern manual and tutor manual for the pre-registration training (South African Pharmacy Council, 2017a). The second part of the interview guide explored the interns' perceptions of preparedness for the job functions they undertake, the generic skills preparedness, challenges experienced, and their recommendations to increase graduates' preparedness (Appendix E). The researcher used the literature to construct the open-ended questions in the second part of the interview guide and participants were able to narrate their initial perceptions of preparedness from the open-ended structure of the questions. Lastly, there were closed-ended questions which gathered demographic information from interns when the interview ended (Table 1). The interviews were audio-recorded and the researcher also had a notebook to record some aspects such as emotions captured when participants were telling their stories. The time for conducting the interviews ranged from 34 minutes to 58 minutes. During the interview, all the interns highlighted that they had been exposed to some of the job functions but not all due to the rotation system used in the industrial pharmacy for training. Therefore, interns were able to judge their skills preparedness only for the areas to which they had been exposed. Following the interview, the audio records were then transcribed verbatim by the researcher and kept safely. The transcripts were later returned by email for verification purposes and participants requested to sign and return a transcript verification form (Appendix F). All graduates signed the transcript verification forms.

3.6.1 Role of the researcher

Due to the close association that a qualitative researcher has with data, there is a high likelihood for aspects of researchers' bias to affect quality of the data which therefore

necessitates the researcher to explain to readers aspects that may lead to bias during the collection and analysis of data and how they were minimised (Stake, 2010). The researcher, therefore, minimised bias by asking the open-ended questions as outlined in the interview guide. Any probing questions that the researcher asked were not leading and participants were asked to clarify further aspects of their views which were not clear. This ensured that the views captured belonged to participants and not the researcher. There is also limited bias from the researcher as she did not study her BPharm degree in SA and she, therefore, has no perceptions of whether curriculum prepared graduates or not. Furthermore, audio recorded data was transcribed word-by-word and analysis of data was inductive to minimise bias that can arise when the researcher has preconceived codes and themes (O'Keeffe, Buytaert, Mijic, Brozović, & Sinha, 2016).

3.7 PILOT STUDY

The researcher carried out a pilot study through semi-structured interviews with two people: one a pharmacist who was previously an intern in the industrial pharmacy and the other an industrial pharmacy intern. The intention of doing the pilot study was to establish the feasibility of the study, refine the research questions and determine if they cover all the essential aspects of the research (Brace, 2008) The researcher used the results from the pilot study to refine and finalise the questions in the interview guide and change the audio recording equipment to one that had better sound quality. Finally, the researcher used experience from the pilot interviews to refine the interview questioning technique to ensure a smooth process.

3.8 DATA ANALYSIS

During qualitative data analysis, the researcher attempts to derive meaning and gather more information and clarity about the research phenomenon being explored as described by

the participants (Flick, 2013). The analysis of data in this research followed the stepwise approach suggested by Creswell (2009, p. 185) which first involved turning audio-recorded data into text data a process called transcription. Through transcription, the researcher was able to access the audio-recorded data in a Microsoft® word document which was later analysed by coding. The transcription of the interviews was verbatim meaning that all the pauses and pronunciations were captured as recorded but, any information that could reveal confidential information related to participants such as university name were removed before analysis. The researcher then read the transcripts several times and frequently listened to audio records to get accustomed to the data and understand the meaning it represents as narrated by the participants. Afterwards, the researcher imported the transcripts into the Atlas.ti® software (version 8.0) and began the inductive content analysis process. The software helped in managing large interview generated data and assisted the researcher in carrying out a speedy analysis. During the inductive content analysis, the researcher read the transcripts line by line and then coded the data by assigning a word or phrase that represents overall meaning in line with the research objectives (Anandarajan, Hill, & Nolan, 2018). Inductive content analysis was used due to its suitability in cases where there is limited related research done, as is the case with this current research. Through inductive content analysis, the researcher formed themes by classifying codes which led to research findings emerging from the frequent or dominant themes (Eagan, Misfeldt, & Siebert-Evenstone, 2019).

The coding mentioned above was done through open and *invivo* coding. During open coding, a label representing meaning from participants quotations was assigned using a word or short phrase while, in *invivo* coding, a label was assigned using exact words used by the participants (Saldana, 2012). In the next step, the researcher formed code groups by classifying codes that have the same meaning or context in the Atlas.ti® software. During the grouping of

codes into themes, some codes were classified in more than one theme in line with the broad description of the theme. Grouping and labelling of themes concerning how they answered the research aim and objectives followed. The researcher then reviewed the themes constantly to ensure that the codes represent and capture the meaning assigned to the theme (Merriam & Tisdell, 2016). The smaller groups were classified as subthemes and assigned to different themes according to their relation to the main theme (see Table 2). A narrative passage was written under the comments section of the Atlas.ti® software to reflect the meaning behind each theme to assist an independent reviewer to understand what each theme represents. An independent reviewer with experience in qualitative studies was therefore requested to review and produce a report to assess whether the assigned codes and themes represent the meaning as viewed by the participants (Appendix G). The research findings as captured in each theme were then discussed and compared with literature to answer the research question. More detailed description of themes and subthemes will be given in Chapter four.

3.9 TRUSTWORTHINESS

Trustworthiness establishes whether the findings of a qualitative study are worth taking into account and if readers can be persuaded to rely on them (Cypress, 2017). Researchers can use several approaches to establish the trustworthiness of the research findings including; credibility, transferability, and dependability amongst others (Elo et al., 2014). Trustworthiness was attained through credibility and dependability in this study. Credibility establishes whether the study findings reflect the meaning and information given by participants and is well interpreted (Noble & Smith, 2015). In order to determine credibility, transcripts were returned to participants by email for them to validate if what was transcribed captured their perceptions and to correct any wrong interpretations where necessary. All participants but one agreed with

the information on the transcript and returned signed transcript verification forms (Appendix F) to the researcher. The participant who did not agree with some aspects of the captured information, made some minor changes to the transcript and the changes were captured for the final analysis. Also, data analysis was conducted by the researcher and another independent coder experienced in qualitative data analysis was engaged and they both discussed the coding process until an agreement was reached (Noble & Smith, 2015).

Also, dependability which involves procedures to ensure that the research findings can be relied upon and can be repeated by anyone was established by keeping records of all the field notes and audiotaped interview discussions for scrutiny by an independent reviewer to ensure that the final results reflect the information given by the participants.

3.10 ETHICAL CONSIDERATIONS

The researcher maintained ethical principles in the implementation of this study first by requesting approval to conduct the study from the Nelson Mandela University Research and Ethics Committee-Human (REC-H) and the Faculty Postgraduate Study Committee (FPGSC) before the study commenced (reference number H19-HEA-PHA-001) (Appendix A). Secondly, the researcher requested approval by writing a letter to the industrial pharmacies where interns were working to interview the interns at the plants (Appendix B). Only one industrial pharmacy accepted the request for interns to be interviewed at the plant. Lastly, ethical considerations were also aligned to the principles of the Belmont report as cited by Bromley, Mikesell, Jones, and Khodyakov (2015) through application of the following: respect for person, beneficence, and justice.

3.10.1 Avoidance of harm

According to the principle of beneficence, participants should not be exposed to any harm when they participate in research studies (Friesen, Kearns, Redman, & Caplan, 2017). Due to the nature of this study, there was no exposure of pharmacy graduates to any form harm either physically or psychologically. In addition, justice was maintained when data was gathered from participants by adhering to the outlined objectives without overburdening the participants with unnecessary questions.

3.10.2 Voluntary participation

Before the study commenced, participants were reminded that their involvement in the study was voluntary as previously highlighted in the disseminated recruitment letter and that they were at liberty to withdraw from the study at any time if they do not feel comfortable (Friesen et al., 2017).

3.10.3 Informed consent

In order to apply the principle of respect for persons as reflected in the Belmont report, participants were asked to sign a consent form (Appendix D) before commencing the study, including consent to audiotape the interviews. Before signing the consent form, participants were reminded of the goals and objectives of the research and their liberty to stop the interview if they feel uncomfortable.

3.10.4 Confidentiality and anonymity

Confidentiality and anonymity of participants was maintained by assigning a number not names to identify participants and data collected and transcribed was kept secured at all times in a file and placed in a locked unit (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014).

3.11 LIMITATIONS OF STUDY

The study encountered the following limitations:

- The researcher failed to get access to interns working in industrial pharmacies; hence, the size of the sample was small, a more significant sample would increase the reliability of the study.
- Only graduates from three schools of pharmacy took part in the study. The participants from other universities may have different views of perceptions.

CHAPTER 4

FINDINGS AND DISCUSSIONS

4.1 INTRODUCTION

The overall intention of this study was to determine pharmacy graduates' perceptions of their preparedness to undertake internship responsibilities in the industrial pharmacy setting. The research question was, therefore answered by employing a qualitative methodology.

This chapter presents the findings related to this study to derive answers related to the achievement of the research aim and objectives. The primary aim of this study was to gain an understanding of the perceptions of pharmacy graduates regarding their preparedness for work in the industrial pharmacy. And the study objectives were to gain an understanding of pharmacist interns in industrial pharmacy, perceptions of their preparedness concerning: the technical skills required of intern pharmacists in industrial pharmacy and the generic skills required of intern pharmacists in industrial pharmacy.

The chapter will, therefore, present the opinions and experiences of research participants regarding their perceptions of preparedness shared during the semi-structured interviews. The research findings presented in themes and subthemes will be discussed and compared to the existing literature. This will enable the researcher to gain more understanding into the perceptions of pharmacy graduates undertaking internship in the industrial pharmacy setting of their preparedness to perform tasks and undertake responsibilities requested of them.

4.2 PARTICIPANTS PROFILES

The participants in this current study included a total of four pharmacy graduates currently undertaking their internship training in the industrial pharmacy sector. The graduates

had previously graduated from schools of pharmacy in three universities namely; Witwatersrand University, North-West University, and Tswane University of Technology. The characteristics of pharmacy graduates who participated in this study are described in the table that follows (Table 1).

Table 1: Demographic characteristics of the participants and the duration of the interview sessions

Participant	1	2	3	4
Gender	Male	Female	Female	Male
School of pharmacy	University of Witwatersrand	University of Witwatersrand	North West University	Tswane University of Technology
Duration of interview	54 minutes	34 minutes	58 minutes	46 minutes
Ethnic group	Black South African	Black South African	Black South African	White South African
Prior experiential learning in industrial pharmacy	NO	NO	NO	YES

4.3 SEMI-STRUCTURED INTERVIEWS

Four pharmacy graduates undertaking an internship programme in the industrial pharmacy sector participated in the semi-structured interviews. As previously highlighted in chapter three, the interview process commenced by requesting each participant to tick the job functions that they have been requested to undertake since starting their internship programme (Appendix E, Part I). The job functions were extracted from the SA intern and tutor manual for the pre-registration experience of pharmacist interns and summarised in a table format (South

African Pharmacy Council, 2017a). Each participant was given sufficient time to complete Part I of the interview guide (Appendix E) and afterwards, participants were asked their initial perceptions of preparedness to undertake those job functions.

4.4 PRESENTATION OF THE FINDINGS FROM THE SEMI-STRUCTURED INTERVIEWS

This part of the study reports the findings derived from the analysis of the transcripts derived from interviews with individual pharmacy graduates. The results are reported according to the emerging themes that were identified during analysis consistent with the research question while at the same time trying to answer the study aim and objectives. As previously discussed in Chapter 3, the data analysis was conducted by the Atlas.ti® software using inductive coding techniques. The four themes and five subthemes (Table 2) derived after analysis of the transcripts will be discussed in detail in the subsequent sections.

Table 2: Themes and subthemes identified during data analysis

THEMES	SUBTHEMES
Self-perceived preparedness for industrial pharmacy	Reasons for lack of preparedness
	Challenges
	Supportive environment
Preparedness for specific tasks and skills	Theoretical preparedness
Generic skills preparedness	Generic skills required in the industrial pharmacy
Recommendations to schools of pharmacy	

The presentation of the study findings will begin with an introduction of the study objective that will be answered and the theme and subthemes that were formed in trying to answer that objective (Maguire & Delahunt, 2017). In addition, all direct quotations from the participants' transcripts will be presented in italicised font, and participants will be identified using the participant number (e.g. P1). Furthermore, the quotation number as reflected in Atlas.ti® will be provided for easy access by assigned reviewers. In order to get more meaning from the findings, a discussion of how the study findings fit into previous research studies and theories will be presented after the presentation of the findings.

There is generally minimal published research on the perceptions of preparedness of pharmacy graduates that undertake internship responsibilities in the industrial pharmacy setting both internationally and locally. The findings of this study are, therefore expected to shed initial light on the status of SA pharmacy graduates preparedness for industrial pharmacy and increase the literature base.

However, the study also has some limitations, such as a very small sample size; hence, the findings should be viewed and interpreted cautiously. The sample size used was very small due to challenges that the researcher experienced when trying to recruit interns in industry. The researcher, therefore, engaged participants in prolonged discussions to ensure that rich information was gathered from them and the questions were asked in a consistent manner in line with the research aim and objectives to ensure that data saturation occurred amongst their discussions. Transferability or generalisability of the findings can therefore not be implied from these findings due to small size. However, the study does provide a starting point and a basis for further studies in light of the rich data provided by participants.

4.5 OBJECTIVE ONE: PERCEPTIONS OF PHARMACY GRADUATES REGARDING THEIR PREPAREDNESS FOR WORK IN THE INDUSTRIAL PHARMACY

The main goal of the study was to explore the perceptions of pharmacy graduates regarding their preparedness to carry out job responsibilities in the industrial pharmacy. To answer this objective, participants were asked to relate their initial perceptions, experiences, and feelings in association with their level of preparedness to undertake the job responsibilities in the industrial pharmacy (Question 3, Appendix E). Participants were also asked to reflect on any challenges they had encountered, which could be attributed to their level of preparedness. The reflections from participants led to the formation of one main theme: self-perceived preparedness for industrial pharmacy which highlighted that pharmacy graduates were generally unprepared to carry out job responsibilities. Also, the following three subthemes related to the main theme emerged during the data analysis: reasons for lack of preparedness, challenges, and supportive environment.

4.5.1 Self-perceived preparedness for industrial pharmacy

Self-perceived preparedness looks at how each individual perceives themselves to be prepared to do something (Fletcher et al., 2018). This section will, therefore, discuss the individual perceptions of pharmacy graduates regarding their preparedness to start work in the industrial pharmacy setting. All graduates in this study reported an overall self-perceived unpreparedness for the industrial pharmacy as a result of inadequate work-based practical training. Graduates also expressed anxiety related to their abilities to translate theoretical knowledge into skills. The comments and phrases given by participants to highlight their lack of preparedness are captured below:

P1:16:84 ...biggest thing for me was like, would I be able to put all this knowledge I have and translate it into practical work ethic and results.

P2:17:1 ...I really didn't know anything about the pharmaceutical industry...So, it was like a blank canvas...so, you really start relearning more not even relearning, learning new things that are related to what you are doing in the industry. So, maybe I was prepared maybe for like 25% of the things I actually do.

P3:18:38 I was prepared at about 15%...18:40... the company itself knows that we don't have the necessary skills and knowledge to work here... cause theoretically you understand it but before you actually see it you can't comprehend if you haven't actually seen it before.

P4: 21:16 I knew I was not thoroughly prepared but I just saw it as an opportunity for me to engage in industrial pharmacy.

4.5.1.1 Reasons for lack of preparedness

Pharmacy graduates attributed their lack of preparedness for the industrial pharmacy to several factors including lack of practical training, patient-focused education and difficulty in getting industry placement. These factors will now be discussed separately in the subsequent section.

4.5.1.1.1 Lack of industrial pharmacy practical training. Graduates felt that the practical training in their respective university laboratories were small-scale and the lack of work-based training placements in industrial pharmacy settings made it difficult for them to be prepared to perform the required tasks during internship. All participants except one had not been exposed to work-based training in the industrial pharmacy setting during their undergraduate training. Surprisingly, even the participant (P4) who had been to the industrial pharmacy work-based

training for four weeks claimed not to feel prepared due to insufficient time spent in the industry. Supporting statements from participants are listed below:

P1:16:36 practical training was, it was on a more small-scale level.... You did have pharmaceuticals practicals that you'd have in school, but they were on a small-scale level.

P2: 17:24...we were not given practical training preparation for industrial pharmacy. For the other industries yes, but not for the industrial pharmacy. 'Cause like I said we did probably like four or five products during the practicals but it wasn't the actual product.

P3:18;48...In a practical sense because I was not prepared to how to do a lot of processes themselves. So practically, I would say 20% prepared.

P4: In terms of practicals I can say it was not sufficient actually... 21:4 so I can say what I did at undergraduate were just the basics then I got here then I got to see a lot of processes.

4.5.1.1.2 Patient-focused education. The majority of participants readily acknowledged that their perceived deficiencies in preparedness could also be attributed to the undergraduate pharmacy education, which is focused more on training students for retail or hospital pharmacy. This was perceived to lead to a neglect of industrial pharmacy training. In light of this type of patient-focused training, graduates felt more ready for patient care than industrial pharmacy. Statements below highlight graduates' views:

P1; 16;44 there is a gap that they can fill 'cause we do have designated time where you are sent out to pharmacies, you are sent out to hospitals to do practical work... 16.9...so many of the SOPs that we had exposure to were all retail-based.

P2: 17:13 I think they don't really focus on the pharmaceutical industry per se. I don't know the curriculum; I think it's more retail or hospital-based. Because we go into great detail with that...

P3: 18:22 I'm sorry that I'm taking it to retail, but unfortunately that's the biggest thing that they teach you at university. And that's why most people actually go to retail. It's only a few of us that actually go into industry.

P4:21:16 I knew I was not thoroughly prepared, but I just saw it as an opportunity for me to engage in industrial pharmacy, I have been exposed to other sectors, and I have been prepared.

4.5.1.1.3 Difficult to get industry placement. Despite feeling unprepared, the majority of graduates seemed to understand to some extent that their universities were not able to give them essential work-based training in the industries due to limited opportunities for placing students in the pharmaceutical industry. Also, some graduates felt that work opportunities in the industrial pharmacy sector are limited so placing a large focus on industry would lead to a waste of resources. The statements from participants reflecting this are captured below:

P2: 17:22 I know it's very difficult to do hours in the manufacturing company or industrial pharmacy 'cause they are very reluctant to take you just doing like 150 hours.

P3: 18:68 Industry is a lot smaller in the job opportunities that you have let's take for example this year there are about 40 interns for industry across the country, so I think making it that the students have to be more prepared for industry, I think it's a bit....(pause) it's not going to improve anything because there are only a handful of interns that get an opportunity to get to industry.

P4:21:44 I do not think it is possible that you will find a place that has everything in the same setting, so I think they can continue with the one they are doing now.

4.5.1.2 Challenges

Under this subtheme, challenges experienced by graduates during the initial phase of starting the internship will be discussed.

4.5.1.2.1 Mixed emotions. The participants under this sub-theme shared positive as well as negative emotions. Most graduates who had no experiential industrial pharmacy training (P1, P2, & P3) highlighted initial mixed feelings of excitement and anxiety of starting work in the industrial pharmacy since they had not been there before. So, they were excited for the opportunity, yet negative emotions of apprehensiveness and anxiety still surfaced due to unpreparedness.

P1: 16:29 initially, it was a sense of excitement. It was exciting, and I was looking forward to it a lot. But there was naturally kind of uhhhh...(thinking) I wouldn't say scared, but I was nervous. There was a sense of being nervous as to will I be able to kind of put through what I know into action.

P2:17;16 I was very excited. I was very excited. Even though I am a person who likes being prepared, but the company made us feel very comfortable, because we got accepted by everyone.

P3: 18:39 I was excited because I had a lot of exposure to all the other types of opportunities in pharmacy...so, the company made me a lot more comfortable with the fact that I was completely unprepared.

These mixed feelings were also experienced even by the graduate (P4) who had been in the industrial pharmacy during his undergraduate work-based trainingprogram. The participant attributed these feelings to the demanding work in the industry. Graduates statements related to these reflections are highlighted below:

P4: 21:17 I was excited because of the opportunity to do my internship here but at the same time a bit anxious because of the responsibilities that come with working in the pharmaceutical industry...

4.5.1.2.2 Learn on the job. The most prominent challenge that graduates encountered due to unpreparedness was having to learn on the job aspects that their universities had not covered through practical, work-based training. This, in turn, led to some graduates to experience challenges related to adaptation to the work environment. Graduates reflections are captured in statements below:

P1:16:4 To understand the process, yes, but we weren't prepared to plan and execute it. So, I think that's something that we had to learn on the job. 16:14 Initially adapting was very difficult especially at the beginning, I did, I also personally made a few mistakes.

P2:17:15 ...you really start relearning more not even relearning, learning new things that are related to what you are doing in industry. So, maybe I was prepared maybe for like 25% of the things I actually do.

P3: 18:6 after someone explained to me what the process is, and I understood the relevance of why it takes place, but I think the process itself was not explained while we were in university.

P4: 21:14 because the deviation, the risk assessment, they were altogether a new thing to me, so I had to start from scratch for all of them, to understand them...21:36... change control which were new to me, so it was quite a challenge I had to adjust.

4.5.1.2.3 Lack of confidence. Due to the unfamiliar setting and lack of preparedness, some graduates (P1 & P3) initially felt a lack of confidence in their ability to perform tasks while

confidence was high for another graduate (P4) who had been in the industrial pharmacy work-based training before despite self-reported lack of preparedness.

P3:18:19 So, in a way we have been exposed to it, but I would say I am not very confident in myself to do it completely alone.

P1:16:71 So that was I think the biggest thing for me like would I be able to put all this knowledge I have and translate it into practical work ethic and results.

P4: 21:24 I think it was important that we were allowed to get to see how they do things here, before I came here as an intern I knew exactly how they do things here in terms of how things are done the involved processes as compared to someone who was not allowed to come to pharmaceutical industry during undergrad.

4.5.1.3 Supportive environment

Despite the predominant negative emotions that participants felt initially and the self-awareness of lack of preparedness amongst graduates, these negative emotions were soon replaced by feelings of satisfaction. All of the graduates reported a welcoming environment, being supported and not judged by everyone in the industrial pharmacies where they work. One graduate also highlighted that their supervisors knew that they were not prepared for industry since universities do not concentrate on it during training of students and the supervisors would, therefore, give them all the support required for them to acquire all the skills. The following statements from graduates highlight this:

P1:16:48 ...one thing that contributed was the kind of attitude that they have at my workplace. It's a very welcoming kind of attitude and everyone kind of gives you the sense of they want you here, they understand that you are here to learn and that you will ask and that kind of makes it easy for you to ask.

P2:17:19 ... “because you guys are new, and this is not a space that you guys are focused in at university we’re going to allow you to make certain mistakes and we’re here to support you and if you have any questions all the pharmacists are available to help you, the operators there’s just everyone available to assist you”.

P3:18:57 I’m able to ask them questions because they are eager to teach the interns, they understand that we are here to learn.

P4: 21:19 the pharmacist I was working with was quite helpful. Also, they would invite me to their meetings.

4.5.1.3.1 Training. In addition to the supportive environment, graduates appreciate the training that was given by the industrial pharmacies as it helped them in acquiring more understanding and knowledge related to the tasks they had to perform. This training, in turn, helped in the consolidation of theoretical and practical knowledge as reflected by comments from participants (P2 and P3).

P2:17:4 ... like I said, in the beginning, I didn’t know anything that had to do with the pharmacist role in industry, but it was a step by step process on all of them to train me.

P3: 18:60 The company also ensures that you know everything related to it. They have a lot of training that keeps coming out on the electronic system... so you are in a room and realise that you don’t remember a certain process so I would go back to the company document and say ok do I still understand the process.

4.6 OBJECTIVE TWO: PERCEPTIONS OF PHARMACY GRADUATES PREPAREDNESS REGARDING THE TECHNICAL SKILLS REQUIRED OF INTERN PHARMACISTS IN INDUSTRIAL PHARMACY

Objective two of the study was to get clarity of the perceptions of pharmacy graduates preparedness regarding the specific tasks that they were required to undertake in performance of work in the industrial pharmacy. To achieve this objective, participants were asked first to identify and tick the job functions that they were expected to do in the industrial pharmacy (Part I, Appendix E). After ticking the tasks that they have been involved with, participants were then asked to reflect on their initial preparedness to undertake these tasks (Appendix E, Part II Question 1 & 2). The reflections from participants led to the formation of one main theme: Preparedness for specific tasks and skills and one subtheme theoretical preparedness. This theme will elaborate on areas where graduates were prepared and not prepared regarding technical abilities to perform tasks, and the subtheme highlights the theoretical knowledge that graduates perceive to have attributed to their level of preparedness.

4.6.1 Preparedness for specific tasks and skills

The reflections of participants revealed an initial lack of preparedness to perform the majority of tasks that they were assigned due to an inability to integrate knowledge acquired during university training when performing tasks. As previously mentioned, the main cause of unpreparedness was a lack of industrial pharmacy practical training and training that was mostly focused on patient care. Only one graduate (P4) felt reasonably prepared for QC functions, and one graduate (P1) was well prepared for medicine disposal.

The graduate (P4) who was exposed to industrial pharmacy work-based training highlights a fair preparedness for QC skills which was attributed to hands-on practical

training in the industry work-based training for a week. However, the graduate mentioned above also felt that the time spent in QC was short; hence, he was not fully satisfied with the skills he had acquired.

P4: 21:10 We didn't take long in QC; I think we went for a week. We did a testing of raw material and testing of the finished goods when they come in and then in the analysis part; I got to do it when we were releasing products and based on the results you may release your products.

One graduate felt reasonably well prepared for medicine disposal, which he attributed to theoretical knowledge despite a lack of practical training at the undergraduate level.

P1: 16:20 I was very prepared for medicine disposal process. This was something that was covered quite extensively in school and the different processes and the legality behind were covered very well. So when it came time for us to kind of observe and participate in disposing of medicines especially not just the medicines but also the wastes from packaging, and wastes from manufacturing it was kind of a smooth process for me because it kind of give me a practical component of what I already knew

The majority of participants, on the other hand, generally felt unprepared for good documentation skills especially the use of SOPs. Graduates felt that they were never exposed to the importance of management of documents like SOPs until they reached the internship arena, and this came as a shock to them that they had to adapt to.

P1: 16:18 I would say I was not very prepared because from coming out of school we rarely had any exposure to industrial SOPs. So many of the SOPs that we had exposure to were all retail-based.

P2: 17:3 It was new to me. So, I was given the SOPs to read through but, sometimes I didn't understand the SOPs.

P3: 16:33...when, you are physically on the job if there is no signature on the specific part of the process that has taken place, anything that comes after that could be jeopardised. So, I don't think we have enough exposure on how important that part of good documentation is from the university.

P4:21:7 when I got here, I got to see that every process is managed by the SOPs, you cannot do anything without the SOPs. Like when you deviate from the SOP, you have to raise your deviation or raise a change control. So, when I got here, I had to see what goes into the SOPs, that every process is managed by the SOPs. So, when we got training on the SOPs, so I got to see what goes into SOP, that before you do any process, you have to be competent with an SOP. So, I didn't know this from my undergrad.

Most of the graduates felt the lack of QA skills as another deficient skill to which they were never exposed. Graduates felt that the importance of QA and its overall functions were not thoroughly explained in their undergraduate teachings.

P1: 16:13 So coming into the quality assurance space, realising the amount of, the excessive amount of detail that's required in the quality assurance space, the excessive amount of attention to detail that is required of you and the amount of focus that's required to deal with all the different documentations, to assess the different documentations and make sure that everything is quality compliant is something that I think I found very difficult in the beginning.

P3: 18:31 And all of the QA that goes with that. So, no not for a moment did university prepare me for that.

P4: 21:13 I was not prepared at all for quality assurance, I did not know their functions like industry functions that they actually have to approve all the processes they have to see the deviations and approve everything. I wasn't prepared for.

About half of the graduates indicated that their lack of technical skills was as a consequence of inadequate knowledge regarding operation of machinery. The lack of skills in machinery was attributed to the small-scale practicals and lack of industrial pharmacy exposure; hence, a variety of machines were seen for the first time in the internship program.

P3: but as an individual, I was not exposed to all of the different types of things. You knew about the different people that worked in the group, but I didn't work with the tablet machine, I didn't physically have an opportunity to work with the machine.

P1: 16:36 practical training was, it was on a more small-scale level. There were.... You did have pharmaceuticals practical's that you'd have in school, but they were on a small-scale level where you would formulate all these small scale medicines but again it was on a small scale level, and there weren't any machines being used so it would be hand.

Participants were also concerned about their lack of packaging skills, as seen in the statements below. Graduates highlighted that packaging was not well taught in university or explored during the laboratory-based training in university. One graduate (P2) also highlighted that her preparedness to perform tasks related to packaging was only improved by engaging in prior reading of the packaging SOPs before going into the packaging department.

P1:16:16 ...packaging is kind of glanced over and kind of set aside. So the one thing that I'd say was difficult for me was understanding the different methods of packaging because when you come in, there's more easier packaging methods like cartoons and

as time went by we got into more difficult concept like securitainer and blister packaging which then brought more of a challenge to me.

P2:17:6 I had known which department I was going to go to next. And I prior read the SOPs that are used in packaging, and I was a bit more comfortable.

P4:21:12 I was not prepared because during the practicals that we did, we did not do the packaging part we only did the manufacturing part, so I was not prepared at all.

Graduates also reported limited skills in different aspects of production planning. They highlighted that the theory taught at university never focused on aspects of production planning; hence, graduates only learned about the concept during the internship.

P1:16:2 in terms of planning the production process, I would say NO, because, at university level, the focus was predominantly on the theory behind production processes... So, in terms of planning the production process, I was not really prepared. To understand the process, yes, but we weren't prepared to plan and execute it.

P2: ...so we went through the SOPs that explain the procedures for line opening and closing and the pharmacists took me around when they actually did line opening and closing. So, it was more like on the job training

P3: 18:3 to be very honest line opening (pause) I didn't even know what it meant before I came here. There was one of these CPDs from SAPC that we had to do, and someone had to explain to me what line opening means. So, for that one, I would say there was absolutely no preparing for it.

P4: 21:3 I cannot say I was prepared because it was not like one of the focus aspects of our pharmaceuticals module when we did our undergrads. So, I was not really prepared for the line opening.

Some graduates also reported a lack of skills to supervise operators when assigned to perform supervisory task. One of the reasons for this lack of skill was attributed to lack of training; hence, they had to learn the skills on the job ultimately. Graduates highlight that most training in schools of pharmacy are focused on preparing students to work with patients.

P1: 16:22 again, this was something that I would say I was not very prepared for. It is something that you have to kind of learn to execute. Like you said, there are people who have been here much longer, and they understand the machine much better and the processes much better than I do.

16:27 I think dealing with someone who is working under you was something that you had to learn and develop for yourself while dealing with patients is something that is taught very well, and I was very well prepared for.

One graduate also highlighted that she was never exposed to supervising anyone during university training leading to low confidence when supervising in the workplace.

P3: 18:33 there was no one that I had a supervisory role over. 18.34 And I think the only reason why I cope in the supervisory role is because of my personality and my background and kind of my upbringing and not what I learnt at the university at all. 18:39 But in the beginning my confidence was very low to be the sole supervisor.

4.6.1.1 Theoretical preparedness

Despite a lack of preparedness in several technical skills required to perform tasks, graduates were satisfied with the theoretical preparation that they had been afforded with by their respective universities. Yet, graduates had differing views on which aspects of practice for which they felt more prepared. Some participants noted that pharmacy schools focussed

more on the theoretical aspects such as production processes like manufacturing, while others felt that theory was more quality-based as reflected in statements below.

***P1:** 16:33 on a theoretical level I would say I was very, very well prepared...So, my theory was very thorough, especially in terms of manufacturing in terms of quality issues; it was very thorough.*

***P2:** 17:47 Theory we went into great detail. Theory was a great detail. 17:23...It was like the endpoint is the quality where you need to test like a few products for efficacy and for the quality.*

***P4:** 21:37 It was not everything. I think it was balanced.*

In addition, one graduate emphasised that though he was theoretically prepared, a lack of practical preparedness still affected his actual skills in the performance of different tasks' as seen in statements below.

***P1;** 16:11 I think I was really prepared for this, because coming out of school from...there was a specific module that we had called quality assurance in our pharmaceuticals course, so we had a two to three-week exposure to the different aspects of theory of quality assurance.*

16:17 I'm actually in the quality assurance department now so for me it was kind of a culture shock. Kind of going into quality assurance, especially because you are explained the importance more. In school, they explain the importance more of quality assurance, why it should be done but it's not really covered exactly how it's done.

P2: 17:8 ...So, we would know more about quality like your stability testing, and your dissolution in theory. But it wouldn't be a practical application to say that you're going to be making products.

P3: 18:46 *theoretically I understand how the process of what takes place like how the granules and the raw material mixing and blending, how the magnesium stearate works theoretically....*18:47 *I would say it's quite 50% cause theoretically you understand it but before you actually see it you can't comprehend if you haven't actually seen it before.*

4.7 OBJECTIVE THREE: TO GAIN AN UNDERSTANDING OF THE GRADUATES PREPAREDNESS REGARDING THE GENERIC SKILLS REQUIRED OF INTERN PHARMACISTS IN INDUSTRIAL PHARMACY

Through this objective, the researcher wanted to acquire an understanding of pharmacy graduates preparedness concerning the generic skills required of them during the internship in the industrial pharmacy. To achieve this objective, pharmacy graduates were requested to describe their initial preparedness for several generic skills including the ability to communicate with others, the ability to function effectively as a member of a team, and problem-solving skills. Participants were additionally requested to highlight other generic skills that they felt were necessary for a graduate success in the industrial pharmacy and the activities that their universities had engaged them in to ensure acquisition of these skills (Appendix E, Part II, Question 6-9). The discussions from participants led to the formation of one main theme: generic skills preparedness and one subtheme; generic skills required in the industrial pharmacy.

4.7.1 Generic skills preparedness

The majority of participants reported a reasonably fair preparedness with communication and interdisciplinary teamwork skills. The reason for this fair preparedness was attributed to training that was mainly focused on equipping graduates to talk to patients or other healthcare professionals, not other non-healthcare professionals. Also, most activities that graduates were engaged in to prepare them with these skills were only conducted with classmates and not monitored.

The degree of communication skills preparedness reported differed amongst graduates. About half of the graduates reported that their universities engaged them in groups where communication skills amongst group discussions helped in developing communication skills. Some participants highlighted a lack of skills to communicate with supervisors and operators.

P1:16:47 I had a very good experience in communicating because, from school, we had a lot of group interactions. Even in some of my honours projects, we were grouped up together, and we had to collaborate with other students, keep time with them. Students who had other things going on, we had to keep time with them so that kind of developed my communication skills.

P4: 21:25 We worked in groups, so we learned of solving issues as conflicts and communication

Some graduates attributed their improvement in communication to support afforded to them in the industrial pharmacy.

P2: 17:33 But I think my communication skills in a way have improved 'cause now I'm able to express myself more. In the beginning, I'm a very quiet person. So, I used to just

like observe things and be afraid to just ask and say ok, I don't know how to do this, and I'd just figure it out on my own.

17:34 I think the pharmacists would allow them to do that because they wouldn't say she can't do this right now. They would just allow me and say if you make any mistakes, I'll just be here to say ok you didn't do it the correct way. I think in a way, they allowed me to grow.

P4: *21:38 You will find that everyone here is approachable so you can at least talk to anyone, but it depends on how you communicate.*

One graduate in this study felt that the university did not prepare them well for communicating with supervisors or people from lower cadres such as operators due to a focus on training students on how to communicate with patients.

P3: *18:67 There is a small portion of classes that we get on how to communicate. But usually, it's more focused on how to communicate with the patient when you are working in retail. There's not a lot of classes on how to speak to someone who is your manager or supervisor, there's not classes on how to work as a team in working with operators as a team or supervisor. So, there is not a lot of preparation on communication skills from the university side.*

Some graduates also emphasised that the attainment of good communication skills is more of a personal thing that graduates should also learn to develop on their own.

P1: *16:49 But again, it has to come from you, you have to have a will and kind of desire to ask and learn. And I think that's the basis of communication, and that's what I used to kind of get over.*

P3: 18:54 I didn't find it that difficult like I explained like with the other point that we had. I still find it sometimes challenging to talk to people that are in a higher level than I am to get exactly that level of professionalism, otherwise than that I didn't have any problem.

Graduates in this study perceived themselves to be fairly prepared to function as part of teams composed of non-healthcare professionals including engineers, chemists, and IT professionals, amongst others. The reason for fair preparedness as perceived by graduates is because they had been trained to work in teams composed of only healthcare professionals during their training. Graduates felt that this patient and healthcare-focused training was devoid of training opportunities related to aspects of interaction with other professionals who are not health-oriented.

About half of the graduates highlighted that they were still adjusting to functioning in a team of non-healthcare professionals. One graduate also emphasised the importance of a willingness to listen and learn as some crucial skills required for one to be able to function in a team of non-healthcare professionals are learnt through doing it.

P1: 16:50 I think it is an adjustment, it's an adjustment because in school you are basically exposed to nothing but health science students. So even most of it its health science campus so you'd have health science campus and you'd have all the other faculties on the separate campus, so most of the time what you are exposed to is health science students. So, coming into a place where you have people who think completely different from you is something that needs adjusting, and it's something that also needs you to be kind of willing to listen.

P3: 18:53..., there are not classes on how to work as a team in working with operators as a team or supervisor. So, there is not a lot of preparation for communication skills from the university side.

18:56 they do tell us at university on how to work with doctors, nurses, and other people from healthcare. But they never tell us on how to interact with people from other non-health profession.

Another graduate expressed gratitude for being able to work with non-healthcare professional teams but still highlighted the initial challenges encountered.

P2:17:36 Initially, it was tricky because I had never worked with engineers. It was always a multidisciplinary team that was always composed of healthcare workers, doctors and others. So, when you speak to them, you spoke to them in a sense that its medical jargon thing. When I talk about high blood pressure, it's a normal thing; it's just high blood pressure. But now I know that this person is an expert in the field of engineering. ...so, I really learnt a lot with communicating with them in a multidisciplinary team, not just healthcare workers.

In contrast to above views of preparedness, the graduate (P4) who had previously been in an experiential learning program for a month in the industrial pharmacy highlighted that he was fairly prepared to work in a team composed of non-healthcare professionals as he got to interact with a variety of non-healthcare professional and understand their roles.

P4: 21:26 I was fairly prepared because I got to understand different functions of everyone here and that at the end of the day, we are to give inputs to make good quality products. So, I knew with engineering if there is anything that you need from engineering you raise your card and then they come you to fix the stated problem.

The level at which graduates in this study are prepared with problem-solving skills is not clear, their scope of work as intern pharmacists hindered them from solving any problems on their own. All graduates seem to be well prepared for the scope of practice of a pharmacist intern. For any problem that arises during work, graduates have to report it to supervisors who can then be able to solve the problem. Also, graduates seem to solve problems by reporting them to supervisors and asking questions without giving the supervisors their plan of action for solving such problems. To explore this skill, graduates were asked how they would respond to a problem or challenge during work, and the statement below captures their views.

P1: 16:54 ...that's also something that I was very well prepared for the legalities and the procedural aspects of industrial pharmacy we were very well prepared from school. Because, we were very well versed on where the scope of a pharmacist intern starts and where it ends...so I think when you meet yourself in that space, it's very tempting to kind of say; yes I have done this, I understand this, but my first reaction is, look for someone who can supervise as soon as possible. So I think that be your first instinct to kind of look for someone who can supervise.

P2: 17:43 the first thing you do is just alert the operators so that they know that they need to stop. Ok, and then you would inform the production pharmacist, explain why you said the operators should stop and then the production pharmacist would escalate that to the manager and ask how to deal with the problem so just depending on the problem, the first instinct that you are taught is if something is not right you see something is gone wrong on the line is to just tell the operators that this is the problem we need to stop, and I'll come back and inform you on the decision that has been taken. Because I'm not a pharmacist as yet I'll also need to report.

P4: 21:28 I do not think it prepared me to solve any problems if I encountered any problem I would always go to my seniors them and ask how do we handle the situation and they will take it from there and guide me on what we are supposed to do.

One graduate highlighted that though the university had introduced the concept of problem-solving, she was not confident in solving the problem when it occurred due to a lack of practical training in solving an actual problem.

P3: I necessarily didn't handle it in the best way I could, because as I said, the lack of confidence in handling a problem. Because you are exposed to it, but the extent to when you are physically there I was not prepared.

On the other hand, graduates also expressed their lack of preparedness in some of the generic skills that they deemed are required in the performance of work in the industrial pharmacy.

A lack of skills related to time management and multi-tasking were also highlighted by one graduate (P1). However, this graduate still reflected that there were activities that he was exposed to at university where they had to multi-task and manage time. Yet, these activities seem not to be enough in terms of preparing graduates for the amount of time and multi-tasking required in the industrial pharmacy.

P1:16:40 the issue of time management the amount of documentation that need to go through the amount of meetings that need to be had, the different employees and the different aspect of production as a QA pharmacist I would say it wasn't something that I was prepared for.

16:58 ...and kind of time management I think they did prepare us quite well because again in your fourth year you have your honours project, but you also have other

fourth-year course to do. So, the honours project is a self-study project that you do at your own time; you have to manage your own time to make sure that you pass all eight modules and at the same time you pass your honours.

One graduate (P3) also mentioned that the university had not prepared her to work in a multi-cultural context due to a predominantly mono cultured setting in her university.

P3: I think because the interesting challenge that we have in South Africa is the absolute multicultural country that we live in. And for instance, (mentions university name) is very Afrikaans with few English and few other cultures that are within the university, but it's mainly Afrikaans so coming here, obviously in QA, there was a lot of people that kept quiet to themselves, and that's what I felt that everyone was above me.

18:36 ...there is not enough preparation on how to handle it if a person has a different cultural perspective on how something is done because you think everyone has the same professional thinking that you have, but people have different cultures.

Another graduate emphasised a lack of report writing skills which are necessary in an industrial pharmacy setting.

P3: 18:2... but writing a report is still something that we didn't get a lot of exposure in our university. I don't necessarily think we need it only in industry, but we need reports even in retail pharmacies, and that was something that when I was in QA I was like asking myself: am I doing this in the most professional way...

4.7.1.2 Generic skills required in the industrial pharmacy

Graduates also highlighted several generic skills required for survival of graduates in the industrial pharmacy internship area as reflected below:

Most graduates emphasised the importance of generic skills, including a willingness to learn and taking initiatives to ask questions as important skills required in the industrial pharmacy sector.

P1: 16:39 But again, it has to come from you, you have to have a will and kind of desire to ask and learn.

P2: 17:39 I think taking interest and showing that you want to learn really helped me

P3: 18:42 Now in a meeting I ask question. Now in a meeting, if there's something that I don't understand I ask someone that I'm kind of confident with to explain to me.

Other graduates also highlighted the skills that they felt deficient in such as time management, multitasking, report writing, and social skills as important skills with which graduates should be equipped. Graduates felt that these skills would enable interns to survive in the multi-cultural society of SA.

The requirement for skills in time management and multitasking is included in the statement below:

P1: 16:56 again, time management is very important because although you are working under the packaging department, a packaging pharmacist is not only involved in packaging. A packaging pharmacist is also involved in deviations you need to collaborate with QA; you need to collaborate with manufacturing on scheduling on quantities etcetera, so, you need to be able to manage your time properly.

One participant also emphasised the need to have skills in report writing.

P3: 18:11 I think maybe something that could have been included in the fact on how to compile reports. Yes, you learn certain types of writing in school, but in university, we have a few projects, but it's not specific on how to compile a professional report.

The need for cross-cultural communication skills was also highlighted.

P3: 18:61 But I would stress the one, of communicating with people from different cultures because there's some kind of mono-culture from (name of university). We didn't get a lot of exposure to the different types of cultures and how to communicate professionally with them. So, I would stress that.

4.8 RECOMMENDATIONS FOR SCHOOLS OF PHARMACY

One of the outputs this study was to get recommendations from participants on how schools of pharmacy can improve the preparedness of their graduates for industrial pharmacy. To achieve this output, participants were asked to give recommendations that would help increase pharmacy graduates preparedness for industrial pharmacy (Appendix E, question 10).

4.8.1 Experiential placement in industrial pharmacy

All graduates in this study recommended that schools of pharmacy provide practical training in the form of work-based training to help them integrate theoretical knowledge that they have with practice. The statements below highlight the need for practical training.

P1: 16:54 I think it would be beneficial to send out students to industrial sites where manufacturing and packaging are happening where can see that from your final year and not come into the workplace having never been here. I think that is something that they can look at. I think there is another university that actually does that.

P2: 17:13 think they could have collaborated with the pharmaceutical industry without compromising any company.

P3: 18:50 if it is possible if there are pharmaceutical companies that are willing to show the students what the pharmaceutical company holds then yes, I think that would be the way of exposing students to industrial.

The need for more work-based training time was mentioned by the graduate who had been in industrial pharmacy for one month. This graduate pleaded that the university could negotiate with industry to increase time in industry by allowing students to go for learning even on weekends. This graduate also pinpointed that preparedness could be affected by the lack of rotation of students within the industrial department such that students end up being prepared in one department more than in others.

P4: 21:33 Maybe if they suggest that during the experiential learning students can go where ever they want to go and do their experiential maybe if they can communicate with the companies to take students during the holidays for the experiential learning so that maybe they can have sufficient time to train.

4.8.2 Industrial pharmacy specialisation at final year and honours level

One graduate commended for schools of pharmacy to identify students who want to specialise with industrial pharmacy and allow them to pursue it during their final year to increase their skills preparedness.

P3: 18:65 if they want to produce better interns that go into industry to ask us whether we are going to do our internship in industry cause I already knew that I wanted to do my internship in industry at the beginning of 2018 so by the time I do my honours I applied for pharmaceuticals but I got into chemistry so if they took more caution and actually ask students if they're going to do their internship in industry then they would

do their honours on that specific topic so when they work in that, that would make them more prepared.

Similarly, one graduate (P1) who specialised in pharmaceuticals during final year reported a reasonably high preparedness for manufacturing tablets since his research project was focusing on manufacturing.

P1:16:74 In your final year you do honours research, and obviously you have different topics that you choose from so my final year project was on pharmaceutical tablet manufacture, so I did a whole thesis and research project on that. So, when I came here, I had a very good understanding of the process of tablet manufacturing from start to finish. So, I think it gave me, I wouldn't say advantage but say it gave me a very good understanding.

4.8.3 Collaborative teaching

One graduate recommended that schools of pharmacy should allow integration of pharmacy students with other non-healthcare professionals during teaching and research activities to increase graduates preparedness to work effectively in teams composed of engineers and other non-healthcare professionals.

P1: 16:60 I think if you get to fourth year and by some chance your research needs collaboration or needs you to kind of find some outside information, that would be the only time that you find yourself go into other campuses or faculties on a professional level. So it is very difficult to get a sense of how other people think when you are constantly surrounded by people who think the same way.

4.9 DISCUSSIONS

This qualitative study intended to explore the perceptions of preparedness amongst pharmacy graduates undertaking an internship in the industrial pharmacy sector in South Africa. The internship period is designed to be a time when graduates further integrate the knowledge and skills; they had attained in university in performing tasks for preparation to be registered as pharmacists. Throughout the internship period, graduates rotate in different departments of the industrial pharmacy to acquire advanced skills in a variety of industrial pharmacy departments. Therefore, getting feedback from graduates on how prior education from university had prepared them for this important transition phase towards being employed is important. Getting feedback from graduates as stakeholders of HE about their perceptions of preparedness is further essential as such feedback can be used by schools of pharmacy in SA to make curriculum improvements aligned to gaps identified. Semi-structured interviews were therefore ideal an ideal method of inquiry as participants were able to voice their initial experiences and encounters in the industrial pharmacy concerning preparedness. Only one out of the four interns had prior experience for one month in the industrial pharmacy through experiential learning that was arranged in his undergraduate studies. The discussion of the findings will be aligned to the four key themes deduced from the data analysis.

4.9.1 Self-perceived preparedness for industrial pharmacy

The current study findings revealed that all the pharmacy graduates who participated in this study felt significantly unprepared to undertake job responsibilities in the industrial pharmacy. The findings of this study are consistent with results of a study conducted by Saleh et al. (2015) in which students revealed a low interest to pursue careers in industrial pharmacy due to lack of preparedness for the industrial pharmacy attributed to lack of training related to

industrial pharmacy. The self-perceived lack of preparedness of graduates in this study is very worrying as it highlights that there may be a significant imbalance in the pharmacy curriculum towards preparing graduates for practice. The imbalance may in turn, negatively impact the preparedness of graduates who are interested in pursuing careers in the industrial pharmacy sector. Also, this imbalance may signify that the global pharmacy education objective of implementing pharmacy curriculums which are structured in such a way that allows students to have a broad knowledge and skills of all the sectors of pharmacy including industrial pharmacy may not be met (Anderson et al., 2009). In addition, the current findings may also signify that, though the SAPC endeavours' for pharmacy students in SA to be prepared across all the sectors of pharmacy, this may not be the case as reflected by the lack of industrial pharmacy preparedness as perceived by participants (South African Pharmacy Council, 2014). These findings, therefore, may highlight an imbalance in the implementation of the pharmacy curriculum in SA which may require all stakeholders involved in pharmacy education to consider reviewing the curriculum to ensure a balance in preparing students across all pharmacy sectors.

Graduates in this study highlighted several reasons that they perceived hindered them from being prepared for industrial pharmacy, including a lack of work-based practical training, patient-focused education, and difficulty in getting industry placement. Except for one graduate (P4), all participants voiced that their lack of preparedness emanated mainly from a lack of work-based training during their studies. The findings of the current study are similar to the results of a study conducted by Kirby-Smith, Portlock, & Brown (2008) exploring students views of industrial pharmacy in which some of the participants felt that if they had been given practical training through experiential work-based learning in the industrial pharmacy settings they might have had a better view of how industry works. The students in the Kirby-Smith et

al. study above also highlighted that despite having been taught pharmaceuticals, they did not understand the role of pharmacists in industrial pharmacy until they came for an internship. Similarly, an absence of industrial pharmacy work-based training was voiced by graduates of one school of pharmacy in SA through a study determining the work distribution amongst graduates (Dambisya et al., 2005). The graduates in the above study recommended for integration of industrial pharmacy work-based training during undergraduate education to increase the preparedness of students who want to pursue careers in industrial pharmacy.

The benefits of work-based training in ensuring that graduates have a better transition to work and being ready to start work is widely reported in literature (Cox, 2016; McCowan, 2014). Amongst these benefits, is the exposure of students to hands-on experiences where students can learn through actual performance of tasks which help in honing their skills. As highlighted by the industrial pharmacy supervisor in one study, experiential work-based learning programs also allow students to be introduced to a variety of activities which occur in the industrial pharmacy workplace which can enhance their preparedness (Lucas, Williams, Tudball, & Walpole, 2018). The above discussions, therefore, places an obligation on schools of pharmacy to work towards ensuring students placements in the industrial pharmacy settings during their undergraduate training where they can be introduced to tasks related to their future roles in industry.

Surprisingly, even the graduate (P4) who had been exposed to industrial pharmacy work-based training before for a month also expressed lack of preparedness. This lack of preparedness could be attributed to inadequate time that the graduate spent in the industry where he had to learn all the aspects of industry within only a month. This finding coincides with recommendations from a study by Broad (2018) whose recommendations highlighted that

work-based training programmes of students should take enough time for them to have the desired impact of nurturing students skills.

One graduate (P2) in the present study also mentioned that the products made during the small-scale pharmaceuticals practical were not real as compared to the actual products seen in industrial pharmacy. This feeling coincides with views from authors of a study assessing pharmacy education in India who concluded that the compounding in pharmacy schools might no longer be relevant in light of the increased acceptability of manufactured ready to use products over compounded products (Basak & Sathyanarayana, 2010). In contrast to the unfavourable views about compounded products, literature has highlighted that compounding skills amongst graduates are still necessary especially in community and hospital pharmacy settings where some patients medical needs can only be met through compounding, not through standardised manufactured product (Roark, Anksorus, & Shrewsbury, 2014). In light of the above discussion, schools of pharmacy should consider complementing lab-based compounding practicals' with placement of students in industrial pharmacies where they could get practical training and also observe the manufacturing of real conventional products. These lab-based training experiences will likely help in building students' skills which will further be nurtured during internship training after graduation.

In addition to a lack of practical training, the findings of this study reveal that graduates also attributed their lack of preparedness to a patient-focused pharmacy education with minimal focus on training students for the industrial pharmacy setting. Similar findings have also been raised by other researchers who reported that the clinical focus of pharmacy education led to graduates who are not adequately prepared for industrial pharmacy (Abduelkarem, 2014; Refai & Thompson, 2015; Shen et al., 2014). Furthermore, a study in SA also highlighted the clinical

focus of the pharmacy curriculum in SA as evidenced by most experiential learning hours being spent on practical clinical training in the retail and hospital pharmacy settings (Boschmans & Kairuz, 2009). The clinically-focused education and training mentioned above may lead to graduates who are more prepared for hospital and community pharmacy at the expense of industrial pharmacy preparedness as evidenced by the findings of this study. This disparity in focus, therefore, necessitates that measures be put in place for the implementation of a pharmacy curriculum that ensures that students are not only prepared for patient care but also for other sectors such as industrial pharmacy. Also, schools of pharmacy should ensure that theory also introduces aspects of roles and responsibilities in the industrial pharmacy to increase students understanding and interest of the industry (Saleh et al., 2015).

The majority of graduates in this study also attributed their lack of preparedness to limited places for work-based trainingplacement of students in industry. The difficulties faced by universities to get work-based trainingsites including those in industrial pharmacy as viewed by graduates in this study is widely discussed in literature (Cox, 2016; Kirby-Smith Janice, Portlock, & David, 2008). When it comes to difficulties experienced by universities to find work-based trainingsites for industrial pharmacy, such difficulties may be due to a reluctance of those in management in the pharmaceutical industry to take students for work-based trainingprograms because of quality concerns and regulatory requirements (Lucas et al., 2018). In light of this, schools of pharmacy should explore other opportunities for building relations with industrial pharmacies to place students in industries for experiential learning. These opportunities include negotiating experiential placements in industries where graduates can be exposed to an assortment of technical activities in the industry without directly taking part in processes where quality can be affected. Furthermore, instead of requesting placements at one specific time in industry, small groups of students can be taken for several visits to the industrial

pharmacy throughout the academic period where they would be oriented to the role of pharmacists in industrial pharmacy (Saleh et al., 2015).

Participants in the present study also experienced some challenges attributed to lack of preparedness. The most prominent challenges that participants experienced were mixed feelings, having to learn skills on the job, and lack of confidence. Participants initially went through a roller-coaster of emotions ranging from excitement for beginning an industrial pharmacy internship while at the same time, feelings of anxiety and doubt were prominent. Negative feelings of fear and anxiety during the internship period such as those experienced by participants in this current study have been widely discussed in literature and have been linked to minimal skills and knowledge amongst participants and being in an unknown setting for graduates who were not exposed to work-based training opportunities before graduation (Mata, Ramos, Kim, Guille, & Sen, 2016; Milligan, 2016). In contrast, the graduate (P4) who had been through practical training in the industrial pharmacy attributed the anxiety he felt to thoughts about the demanding work in the industry rather than anxiety about the unfamiliar. These reflections from the majority of participants highlighted the need for curriculum redesigns which will increase students' exposure to the industrial pharmacy as a way of reducing the initial stress that is attributed to lack of knowledge and skills and being in an unfamiliar environment.

The most overarching adaptation challenge that graduates in this study had to endure was having to learn things on the job. Similar findings to the current study have been seen in studies of graduates preparedness in the medical field whereby supervisors found themselves in an unfavourable position of not supervising graduates but teaching them skills they were supposed to come prepared with (Muthaura et al., 2015). Ideally, the internship is supposed to be a period

when graduates skills are further nurtured, not where they are taught things from scratch. Having unprepared graduates as seen in this study can waste not only the time of the supervisors but also frustrate graduates who have to learn new things without building upon prior knowledge (Hannan et al., 2018; Langworthy, 2019; Stewart et al., 2016). As previously discussed, increasing student placements in work-based training could help graduates to make a better transition to their first jobs as interns.

Some participants (P1 & P3) who had not been exposed to experiential learning training, experienced significant challenges with confidence in interacting professionally as opposed to the participant (P4) who had experience with industrial pharmacy whose confidence was higher. These findings are somewhat similar to findings of a study by Chesser-Smyth (2005), whose study demonstrated that confidence in students who had been exposed to experiential learning was high when compared to those who had not been there. The confidence seen in the participant (P4) who had been involved in work-based training before was attributed to feelings of security as a result of being in familiar settings but not necessarily preparedness as seen in his reflections.

Despite the challenges and feelings of unpreparedness that interns experienced during the internship in the industrial pharmacy, it is encouraging to learn from interns reflections that they had an overall fruitful experience in the industrial pharmacy due to the supportive and encouraging environment. Graduates also expressed gratitude for the training that they found valuable in helping them acquire skills in this important transition phase of their profession. Research also advocates that support and training given to newly recruited staff such as interns is essential in reducing stress and ensuring that they can feel comfortable and therefore pick up skills on time (Jokhio, Panhwar, Sultan, & Fatima, 2019).

On the same note, though the study purpose was not to determine the association of demographic characteristics to perceived preparedness, the study findings reveal that gender did not influence preparedness as both males and female felt unprepared for industrial pharmacy. These findings are similar to results by study by Kirby-Smith et al. (2008) who found that a lack of understanding of industrial pharmacy preparedness to be quite similar amongst both males and females.

4.9.1.1 Summary

The above discussions highlight that pharmacy graduates perceived themselves to be unprepared for industrial pharmacy because of a variety of reasons including; lack of work-based training in industrial pharmacy, patient-focused education, and limited opportunities for placement of students in industrial pharmacy. As a result of being unprepared, the majority of graduates experienced initial anxiety and low confidence due to being in an unfamiliar environment and having to perform tasks with which they are not competent. In light of the preceding discussions, schools of pharmacy should, therefore, collaborate with industrial pharmacies to find ways of increasing students placement in pharmacy industrial to improve students' knowledge and skills needed to perform tasks in the industry. Employers in industrial pharmacy can also be convinced that having prepared graduates in internship due to previous work-based training placements will also minimise the time that is spent supervising unprepared graduates. Moreover, schools of pharmacy should also strike a balance in the implementation of the curriculum by ensuring that students are taught all aspects of pharmacy related to their future professional roles.

4.9.2 Preparedness for specific tasks and skills

The findings of this study reveal differing levels of preparedness amongst graduates with two graduates feeling fairly prepared for certain tasks, but all graduates felt unprepared to perform all the tasks assigned to them. One graduate (P1) of the two fairly prepared graduates, felt reasonably well prepared for QC (P4) while the other graduate (P1) felt fairly prepared for medicine disposal. Preparedness was classified as fair because Participant 4 felt that though he had been exposed to QC tests in the pharmaceutical industry, the time spent in the testing department of the industrial pharmacy was minimal while, Participant 1 was satisfied with the theoretical training which helped him acquire skills. The graduate with disposal skills preparedness may feel adequately prepared because he was only observing the process taking place. The pharmacist works as part of a team, and his or her role is to ensure that the disposal takes place accordingly and to record the activity to be submitted to management for audit trail (Kümmerer, 2008). On the other hand, fair preparedness with QC skills was attributed to inadequate time spent in the QC department. In light of the role that pharmacists in industry play with regard to the release of product for use, ensuring that graduates acquire skills in QC is essential since their future contribution in QC will enable for products of good quality to be released for use in a timely manner (Costigliola, Ataíde, Vieira, & Sousa, 2017)

All graduates in this study reported that they lacked skills mainly in documentation related to the use of SOPs, QA, production planning, and packaging. Also, graduates felt deficient in performing tasks associated with the use of machinery and with supervising operators. These findings are quite similar to studies by other researchers internationally and in SA which revealed a lack of technical skills including manufacturing and QA amongst graduates (Abduelkarem, 2014; Ackerhans, 2016; Basak & Sathyanarayana, 2010; Luiz & Naude, 2013). The lack of skills in the studies mentioned above were associated with an

outdated pharmacy curriculum, a patient-focused curriculum, and a lack of practical training amongst pharmacy students. While in the current study, graduates attributed their lack of technical skills to a lack of practical training in industrial pharmacies through experiential training, other reasons for the perceived lack of skills were attributed to old machinery which graduates had used in their laboratories which led to product failures. Literature also highlights that pharmacists should have machinery skills amongst other skills to meet the manufacturing requirement in industry (Potdar, 2006). The need for more work-based training of pharmacy student to acquire machinery skills and knowledge is further highlighted through these findings. In addition, the FIP recommends for steps to be taken in pharmacy education that would ensure that up-to-date resources such as equipment in pharmaceutical science laboratories are available which would ensure that students benefit from practical training with such resources (Bader et al., 2017).

Despite an overall lack of preparedness amongst graduates, a commendable finding was the overall satisfaction of graduates with the theoretical preparation that they received from their respective schools of pharmacy. However, differing views suggesting that theory was more focused on some aspects such as quality and production processes rather than on other areas were also highlighted. However, despite this theoretical knowledge gained through undergraduate training, graduates also pinpointed that they still lacked practical skills and were therefore unable to perform tasks. These findings resonate with the results of a study conducted by Kirby-Smith et al. (2008), where students' revealed that despite all the theory they got from pharmaceuticals, they still lacked industrial pharmacy preparedness. These findings further highlight the importance of placing graduates for industrial pharmacy work-based training so that they can be able to integrate theory with practice and hence skills.

4.9.2.1 Summary

Under this theme, a few graduates perceived themselves to be prepared for QC and medicines disposal skills which was attributed to practical training and theoretical knowledge. On the other hand, the majority of graduates felt unprepared for performing several tasks including deficiency in many skills related to use of documents, QA, packaging, use of machinery, production planning, and supervision of operators. These deficiencies in technical skills and ability to perform tasks were still highly attributed to lack of practical training in the industrial pharmacy since graduates expressed that their theoretical preparation had covered some of these tasks, but they could not perform them due to lack of practical training. These findings still highlight an overarching need for schools of pharmacy to provide graduates with practical training through work-based training experiences where they can have opportunities to integrate theory with tasks which will, in turn, result in improved abilities to perform tasks.

4.9.3 Generic skills preparedness

Furthermore, the findings of this study suggest that graduates deemed themselves to be fairly prepared with generic skills such as communication and multi-disciplinary teamwork. The fair preparedness was attributed in part, to the fact that though graduates had been exposed to activities which helped them develop generic skills such as group work where they worked in teams, communicated and solved problems, these activities were done with classmates or other students doing health-related courses. Students, therefore, felt that the skills that they developed during the classroom activities mentioned above would be more applicable in healthcare scenarios such as retail and hospital practice settings. In light of the above discussion, pharmacy students should be made aware of the generic skills that they are supposed to acquire before graduation and that, the activities they are engaged in such as group work are meant to help them nurture such skills. At the same time, it is important for pharmacy educators to

monitor such activities to ensure that graduates develop the desired generic skills. The results of supervised team-based training in SA revealed that students felt satisfied in their ability to solve problems and communicate effectively with others being engaged in a team-based training strategy (Eksteen, 2019). The results from the aforementioned study highlight that supervised activities such as team-based learning help students to develop the required generic skills.

In addition, students did not feel very comfortable with communicating or working in teams with engineers and other non-healthcare professionals with whom they were not familiar. On the other hand, the participant who had been for industrial pharmacy work-based training experienced overall confidence in communicating and functioning in a team of non-healthcare professionals, since they had previously been exposed to working with them. Research has demonstrated that students who went for work-based training during their studies benefited from acquiring skills such as being able to work with others in teams, being able to engage in written and oral communication, and improvement in presentation skills amongst others (Marrone, Lignell, & Hall, 2006). Furthermore, the findings of one study in SA demonstrate the importance of experiential learning in the acquisition of generic skills amongst students (McCartney & Boschmans, 2018). Students in the aforementioned study, reported an enhancement in their communication skills after being in an experiential learning program. The above discussions highlight the need for schools of pharmacy to consider articulating teaching strategies in ways which will ensure graduates interact with other non-healthcare students. Furthermore, schools of pharmacy should incorporate industry placements to increase students' ability to function in teams of engineers and other non-healthcare professionals.

The level to which participants in this study were adequately prepared for problem-solving is not clear. During the internship, any problem-solving challenge that arised required interns to report to their supervisor without solving the problem themselves due to the requirements of their scope of practice. It is therefore important for supervisors of interns to encourage the development of problem-solving skills in graduates by not readily solving any problems that graduates report immediately. Supervisors can ask graduates to outline the best way to solve the problem, which would trigger graduates to critically analyse ways of solving the problems and offer while remaining within their scope of practice.

The study purpose was also to determine from graduates other important generic skills required in an industrial pharmacy graduate. The findings from this study reveal that graduates felt that other important generic skills for smooth transition of graduates into the workplace include; willingness to learn, time management and multi-tasking skills, report writing and social skills that would enable graduate to function in a multicultural context of SA. Pharmacy experiential learning supervisors listed similar generic skills as skills that students should be assessed on during their placements (Lucas et al., 2018). Also, research highlights that experiential learning programs are important as they can help students acquire these skills during the time they spent on placements (Marrone et al., 2006); further reinforcing the need for graduates to be placed in experiential learning sites to acquire industrial pharmacy skills.

4.9.3.1 Summary

Under this theme, graduates felt fairly prepared with communication and teamwork skills due to patient-focused education. Graduates expressed that most training geared towards the attainment of the aforementioned skills were always done with other healthcare professionals or colleagues and their purpose was to improve patient care. There was no training conducted

towards equipping graduates with skills to work with non-healthcare professionals in industrial pharmacy. Graduates also highlighted a number of generic skills that are required by graduates including; time management, multitasking, report writing and willingness to listen. In light of the above discussion, schools of pharmacy should ensure integrating training towards equipping graduates with the interpersonal skills of communication and ability to work in a team. Attachment of students in industrial pharmacy work-based training can also help in equipping graduates with working with other non-healthcare professional through constant interactions at the workplace.

4.9.4 Recommendations for schools of pharmacy

Graduates in this study recommended schools of pharmacy put in place practical training through experiential learning experiences in industrial pharmacies to increase students' preparation for the industrial pharmacy and equip them with skills that will enable them to be prepared to start work during the internship. The graduate who had been on an industrial pharmacy experiential learning placement also recommended that universities to increase the time that students spend in industry and allow students to negotiate their placements with industry during weekends so that the experiences can be meaningful and not rushed.

One graduate recommended that schools of pharmacy give priority to students who want to pursue industrial pharmacy internship or careers when enrolling students for final year or honours level pharmaceuticals research projects or electives.

And lastly, one graduate recommended that schools of pharmacy should implement teaching strategies that allow integration of pharmacy students with other non-healthcare students during teaching and research activities to increase graduates preparedness to work effectively in teams composed of engineers and other non-healthcare professionals.

4.9.4.1 Summary

Under this theme, graduates made a number of practical recommendations that schools of pharmacy can implement to increase students preparedness for industrial pharmacy including implementing industrial pharmacy work-based training in the curriculum, giving priority to students who want to pursue careers in industrial pharmacy to enrol in pharmaceuticals during the final year and lastly to implement teaching strategies that allow integration of pharmacy students with non-healthcare professionals to increase their preparedness to work in future with these professionals.

4.10 CONCLUSION

This chapter provided a discussion on the study findings with an overall objective of answering the research question and aims. The study findings are extensively discussed and compared with previous researches and literature, as discussed in Chapter 2.

CHAPTER 5

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the conclusions derived from the analysis and discussions of the study findings. Limitations encountered in the implementation of the study and recommendations to advance pharmacy graduates preparedness for the industrial pharmacy are also presented.

The main aim of this study was to gain an understanding of the perceptions of pharmacy graduates regarding their preparedness for work in the industrial pharmacy. In support of this main aim, two objectives developed were to gain an understanding of pharmacist interns placed in industrial pharmacies, perceptions of their preparedness about the following: the technical skills required of intern pharmacists in industrial pharmacy and the generic skills required of intern pharmacists in industrial pharmacy.

5.2 SUMMARY OF FINDINGS

The study intended to answer the following research question: What are the perceptions of interns employed in the industrial pharmacy of their preparedness to undertake the job responsibilities required of them? To answer the research question above, the study findings reveal that pharmacy graduates perceived themselves to be unprepared to undertake the job responsibilities in the industrial pharmacy.

Graduates were generally unprepared in relation to ability to perform tasks related to QA, documentation, packaging, operation of machinery, and supervision of subordinates. A minority of graduates perceived themselves to be fairly prepared to undertake tasks related to

QC and medicines disposal. Furthermore, graduates perceived themselves to be fairly prepared to communicate and function in teams composed of non-healthcare professionals in the industrial pharmacy. The self-perceived level of pharmacy graduates to solve problems is not clear as their scope of work as intern pharmacists hinders them from solving any problems. Instead, graduates have to report any challenges or problems that arise to their supervisors.

All the graduates in this study attributed their lack of preparedness to lack or inadequate experiential, practical training in the industrial pharmacy, and the patient focused pharmacy education in their undergraduate education. What is commendable however, is the fact that all graduates were significantly satisfied with the theoretical preparation that was afforded by their respective universities.

5.3 LIMITATIONS

The following are specific limitations that were experienced during this study implementation.

- The findings of this study were limited by the small sample used. Use of additional participants could have enhanced the study findings. As illustrated in chapter 3, the researcher experienced several difficulties in trying to recruit research participants into the study.
- The participants of this study are only from three out of nine schools of pharmacy in SA universities, which therefore implies that the findings cannot be generalised to other pharmacy graduates. However, the main themes that were developed may apply even to those graduates who did not take part in the study due to the rich information gathered from the semi-structured interviews.

- Data was collected within varying time lengths (June (P1,2,3) and November (P4) such that interns interviewed towards the end may have forgotten their initial preparedness.

5.4 FUTURE RESEARCH

- The study only focused on perceptions of graduates' preparedness but not their actual abilities to perform tasks as seen by their supervisors. Future research to determine the views of supervisors about graduates skills should be encouraged.
- A quantitative study analysing the level of preparedness among all pharmacy graduates can also highlight quantifiable issues on industrial pharmacy preparedness.
- Due to the small size used in this study, findings could not be generalised; therefore, sample size could be increased by using all graduates who undertook an internship in the industrial pharmacy in the previous five years.

5.5 RECOMMENDATIONS TO SCHOOLS OF PHARMACY

Graduates recommended schools of pharmacy include an industry-based experiential learning program in their training to increase their preparedness. In light of the difficulties encountered in placing students for industrial pharmacy experiential learning, schools of pharmacy can consider negotiating with industry management to place students for training not at one specific time but throughout the training period so that students build up skills as they are repeatedly engaged in practice areas. It is also recommended that final year pharmaceuticals honours level specialisation opportunities be given preferentially to students who are willing to pursue careers in industrial pharmacy so that they can get more specialised training in industrial pharmacy. Schools of pharmacy should also try to achieve a balance in preparing students not only for patient care but for other sectors of pharmacy such as industrial pharmacy

through collaborating teaching activities with other non-healthcare professionals where students can learn skills related to communication and teamwork with these other professionals. Future roles of pharmacy graduates in industrial pharmacy include supervisory roles; therefore, students should be given courses and practical training on how to effectively carry out the supervisory role.

5.6 CONCLUSION

In conclusion, the findings derived from this study reveal insights into the perceptions of pharmacy graduates preparedness. Pharmacy graduates' perceived themselves unprepared for industrial pharmacy internship due to a lack of work-based practical training during their undergraduate training. Limited placement opportunities in industrial pharmacy contribute to the inability to place graduates in experiential learning experiences. Despite reported satisfactory theoretical preparedness, graduates faced several challenges including having to learn tasks on the job and lack of confidence when deficiency in technical skills such as those related to quality assurance, documentation, production planning, and packaging were revealed due to lack of prior industrial pharmacy practical training. A reasonable preparedness related to generic skills around communication and teamwork was highlighted. Due to the scope of work of intern pharmacists, graduates are unable to solve any problems on their own without supervisors consent. These findings highlight a gap in the preparation of pharmacy graduates for industrial pharmacy and can, therefore, be used to improve pharmacy curriculum implementation strategies by schools of pharmacy, improve the transition from school to internship for industrial pharmacy interns, and ensure that employers get well prepared and skilled graduates.

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APPENDICES

Appendix A: Ethics approval letter NMU



Copies to:
Supervisor: PROF SF BURTON

Summerstrand South
Faculty of Health Sciences
Tel. +27 (0)41 5042956 Fax. +27 (0)41 5049324
Marilyn.Afrikaner@mandela.ac.za

Student number: 215282701

Contact person: Ms M Afrikaner

01-MAR-2019

MRS PUTSOANE
PO BOX 12264
MASERU
LESOTHO
100

OUTCOME OF RESEARCH/PROJECT PROPOSAL:

Qualification: 20401 MPharm (Industrial: Coursework)

PERCEPTIONS OF THE PREPAREDNESS OF PHARMACY GRADUATES FOR INTERNSHIP
RESPONSIBILITIES IN THE INDUSTRIAL PHARMACY

Please be advised that your final research proposal was approved by the Faculty Postgraduate Studies Committee (FPGSC).

FPGSC granted ethics approval. The ethics clearance reference number is H19-HEA-PHA-001 and is valid for three years.

We wish you well with the study/project.

Kind regards,

A handwritten signature in black ink, appearing to read "M Afrikaner".

Ms M Afrikaner
Faculty Postgraduate Studies Committee (FPGSC) Secretariat
Faculty of Health Sciences

Appendix B: Company letter of request



Date:

The Human Resource Office /Interns Manager

I humbly request permission to conduct the data collection for a research project that I am completing as part of my Master's in Pharmacy – Industrial programme at your plant. The primary aim of this study is to describe the perceptions of pharmacy graduates undertaking internship in the industrial pharmacy regarding their preparedness for the workplace in terms of their knowledge and skills. The study seeks to identify interns perceptions of shortcomings in their competencies during the internship that could be attributed to inadequate prior learning during their university education and to seek advice from interns on what pharmacy schools can do to overcome the shortcomings. The study results will then be disseminated back to your company and Schools of Pharmacy around the country. The details of the study are as follows:

- Participation in this study will involve an in-depth interview with the pharmacy interns which should take about 45 minutes. It is envisaged that the interview will be conducted at the workplace or any place that may suit you.
- The interview will be digitally recorded, and field notes may be taken by the researcher during the interview.

- Participation in this study is entirely voluntary and interns will have the right to withdraw from the study at any time.
- Confidentiality will be ensured, and no names or other identification attributes will be attached to the interviews or transcripts thereof or be made know to anyone beyond the researcher and the study supervisor.
- Intern participants will be invited to view the transcripts, analysis, interpretations, and descriptions obtained from the interview so as to validate the accuracy and transparency of the transcripts, field notes and interpretations of the researcher. Participants will have the freedom to suggest the removal of information that may lead to the exposure of the company or their personal identity.
- Participation in the study will not result in any cost to the pharmacy interns or the company.

Hoping this meets your favourable consideration

Yours sincerely

Mathabelo Putsoane (BPharm)

Email: s215282701@mandela.ac.za

Appendix C: Intern Pharmacist Recruitment letter



Date:

Contact person: Mathabelo Maliboche Putsoane

I hereby invite your participation in a research project that I am completing as part of my Master's in Pharmacy– Industrial programme. The primary aim of this study is to describe the perceptions of pharmacy interns employed in the industrial pharmacy regarding their preparedness for the workplace in terms of their knowledge and skills.

The study seeks to identify interns perceptions of shortcomings in their competencies during the internship that could be attributed to inadequate prior learning during their university education and to seek advice from interns on what pharmacy schools can do to overcome the shortcomings. The study results will then be disseminated back to Schools of Pharmacy around the country.

The details of the study are as follows:

- Participation in this study will involve an in-depth interview with the researcher, which should take about 45 minutes. It is envisaged that the interview will be conducted at any place convenient to you.
- The interview will be digitally recorded, and field notes may be taken by the researcher during the interview.
- Your participation in this study is entirely voluntary and you have the right to withdraw from the study at any time.
- Confidentiality will be ensured, and no names or other identification attributes will be attached to the interviews or transcripts thereof or be made known to anyone beyond the researcher and the study supervisor.
- You will not incur any harm or cost from participating in the study.
- You will be invited to view the transcripts, analysis, interpretations, and descriptions obtained from the interview; so as to validate the accuracy and transparency of the transcripts, field notes and interpretations of the researcher. You will have the freedom to suggest the removal of information that may lead to the exposure of your identity.
- Your participation in the study will be deeply appreciated.

Regards

Mathabelo Putsoane (BPharm)

Email: s215282701@mandela.ac.za

Appendix D: Consent Form

<u>RESEARCHER'S DETAILS</u>						
Title of the research project	Perceptions of the preparedness of Pharmacy graduates for internship responsibilities in the pharmaceutical industry					
Reference number	H19-HEA-PHA-001					
Principal investigator	Mathabelo Maliboche Putsoane					
Address	Ha Tikoe Maseru, Lesotho					
Postal Code	100					
Contact telephone number	(00266) 59412653					
<u>A. DECLARATION BY PARTICIPANT</u>						
I,the participant and the undersigned						
<p>CONFIRM THAT I WAS INVITED TO PARTICIPATE IN THE ABOVE RESEARCH AND THAT THE FOLLOWING ASPECTS HAVE BEEN EXPLAINED TO ME:</p> <ul style="list-style-type: none"> • The aim and objectives of the study. • The procedure for carrying out the study. • My identity will not be revealed in any discussion. • I am participating voluntarily, and I am at liberty to withdraw from the study at any time if I do not feel comfortable. • If I choose to withdraw, that will not affect my future or employment. • I was given the opportunity to ask questions and all these questions were answered satisfactorily. 						
<p>I HEREBY VOLUNTARILY CONSENT TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT:</p> <p>Sign:</p> <p>.....</p>						
<table border="1"> <tr> <td>Signed/confirmed at.....on2019</td> </tr> <tr> <td>Signature of witness:</td> </tr> <tr> <td>.....</td> </tr> <tr> <td>Name of witness:</td> </tr> <tr> <td>.....</td> </tr> </table>		Signed/confirmed at.....on2019	Signature of witness:	Name of witness:
Signed/confirmed at.....on2019						
Signature of witness:						
.....						
Name of witness:						
.....						

Appendix E: Interview Guide

PART I

Job functions for industrial pharmacy intern	YES	No
<u>MANUFACTURING AND GMP</u>		
<ul style="list-style-type: none"> Plan the production process (organise resources and prepare materials according to SOP) 		
<ul style="list-style-type: none"> Prepare for line-opening/line closing 		
<ul style="list-style-type: none"> Control the production of pharmaceutical products (organise resources and ensure adherence to SOP) 		
<ul style="list-style-type: none"> Ensure that in-process control, quality testing and quality awareness is maintained during production 		
<ul style="list-style-type: none"> Manage deviations; take corrective action and record findings 		
<ul style="list-style-type: none"> Ensure systems and procedures are adhered to 		
<ul style="list-style-type: none"> 		
<u>GOOD DOCUMENTATION PRACTICES:</u>		
<ul style="list-style-type: none"> Ensure documents are completed and maintained 		
<u>QUALITY CONTROL</u>		
<ul style="list-style-type: none"> Test materials and products for quality confirm outcomes against specified standards. 		
<u>PACKAGING</u>		
<ul style="list-style-type: none"> Follow packaging process for different dosage forms Adhere to packaging documentation and other guidelines 		
<u>QUALITY ASSURANCE</u>		

<ul style="list-style-type: none"> • Participate in QA meetings 		
<u>MEDICINES DISPOSAL</u>		
<ul style="list-style-type: none"> • Participate in medicine disposal/destruction. 		
<u>MEDICINES REGISTRATION</u>		
<ul style="list-style-type: none"> • Compile medicine registration dossiers according to SA legislation. 		
<u>SUPERVISION</u>		
<ul style="list-style-type: none"> • Perform supervisory activities when assigned 		

PART II INTERVIEW GUIDE

1. What job responsibilities do you think have been left off this list that you are expected to do?
2. Looking at the job functions that you are expected to do as an intern, can you tell me about your perception of preparedness to undertake the above job responsibilities when you were first hired?
3. How did you feel with regard to preparedness to undertake the job responsibilities in an industrial pharmacy?
4. What were your initial challenges as an intern in relation to preparedness for performing these job responsibilities?
5. How did your undergraduate education prepare you with the theoretical and practical training necessary for the job responsibilities you were expected to undertake?
6. Tell me about your perceptions of your ability to communicate with supervisors, colleagues, and other co-workers.
7. Tell me about your perceptions to work in a multidisciplinary team involving people from different educational backgrounds.
8. Can you tell me about how you would respond to a challenge that occurs if you are left alone in a department without your supervisor?
9. Can you tell me about what activities were you involved with at your university to ensure you develop the necessary generic skill? Which other generic skills do you think are necessary for an intern in industrial pharmacy to have?
10. If you were part of a committee planning curricula for B. Pharm qualification, what would be your recommendations regarding practical steps that pharmacy schools can put in place to ensure pharmacy graduates are prepared for internship in a pharmaceutical industry?

Demographic information

School of pharmacy:

Gender	Male	Female

Appendix F: Transcript Verification form

PARTICIPANT ACKNOWLEDGEMENT FORM FOR TRANSCRIBED DATA

Please complete the participant acknowledgement form below if you acknowledge that you received the transcribed data (**audio data turned into written word document**) representing what you said during the data collection done by the researcher.

Dear Participant, Thank you for your participation. All information on this form is kept confidential.

By signing this form, I acknowledge that I have received transcribed copy of the data collected by the researcher and it represents the words and meaning from me.

Research title: Perceptions of the preparedness of pharmacy graduates for internship responsibilities in the industrial pharmacy.

Researcher name: Mathabelo M Putsoane

Participant details

Full Name:

Email:

Signature:

Date:

THANK YOU

**THE CODING REVIEW FOR THE TREATISE
PERCEPTIONS OF THE PREPAREDNESS OF PHARMACY
GRADUATES FOR INTERNSHIP RESPONSIBILITIES IN THE
INDUSTRIAL PHARMACY**

Mathabelo M Putsoane

s215282701

M Pharm (Industrial)

1. Qualitative data analysis background

1.1 The research question

What are the perceptions of interns employed in the industrial pharmacy of their preparedness to undertake job responsibilities required of them?

1.2 Primary aim

The primary aim of this study was to gain an understanding of the perceptions of pharmacy graduates regarding their preparedness for work in the industrial pharmacy related to their technical and generic skills.

1.3 Objectives and analytical tasks

To perform semi-structured interviews to gain an understanding of the pharmacist interns in industrial pharmacy, perception of preparedness with regard to:

- The technical skills required of intern pharmacists in industrial pharmacy
- The generic skills required of intern pharmacists in industrial pharmacy

To analyse the qualitative data collected during interviews

2 TRANSLATION PROCESS AND MECHANISMS

2.1 The primary purpose was to identify the perceptions of pharmacy graduates regarding their preparedness for work in the industrial pharmacy.

2.2 The Researcher develop codes inductively and open and in vivo codes assigned to meaningful data. Codes that belonged together were then grouped in Atlas.ti software into categories representing themes. A description of what each category (theme) was given in the excel spreadsheet.

2.3 The primary selection of tools for qualitative data analysis

The Researcher uses the following components in the coding and translation process with Atlas ti:

- Data management and coding
- Segmenting data – creating and working within defined segment or quotations)
- Conceptualizing data (Using coding

The process from codes was satisfactory. The Researcher identified the main discourse markers and it was clear how pieces of information correlate with each other. The categories have logical grouping and shared commonalities.

All the main themes have been processed and considered in the discussion.