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GAMIFICATION TO MOTIVATE KNOWLEDGE SHARING BETWEEN DISPARATE TEAMS WITHIN AN ORGANISATION

by

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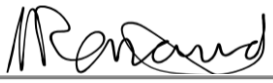
DECLARATION

I, Matthew Renaud, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



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ABSTRACT

The extant body of knowledge suggests that the rate of technological advancement is increasing at an unprecedented speed, forcing organisations to adapt and learn at an even faster rate. Knowledge sharing, defined as an activity through which information, skills and expertise are exchanged between employees, drives organisational learning. While technology advances, organisations need to emphasise and develop a culture of knowledge sharing rather than knowledge hoarding. Managers need to demonstrate the importance of sharing knowledge by motivating their employees and providing a safe, constructive environment to do so.

This study will explore how gamification can be used to motivate knowledge sharing within an organisation across disparate teams. Through the interrogation of the potential of self-determination theory to motivate people, a prototype will be designed to motivate knowledge sharing as part of the Design Science Research Process.

Knowledge sharing within organisations promotes internal learning which improves the quality of product innovation and the overall work performance. When there is little to no sharing of work-related knowledge, it can cause poor organisational decisions and prevent innovation and growth.

Organisations and managers need a system that will encourage and motivate individual employees to share their work-related knowledge in a safe constructive manner, as well as be able to find and process available knowledge. This research will bridge the gap and lean on the views of Mekler, Brühlmann, Tuch, and Opwis (2017) by creating a system and applying gamification as a motivational tool that will encourage and motivate for knowledge sharing.

This study explores a general issue, which may be common across a variety of organisations and industries. In order to measure the effectiveness the artefact has on employees' motivation to share knowledge, the study will make use of the Goal Question Metric approach.

The outcome of this research is a gamified knowledge sharing system that will encourage and motivate employees to share work-related knowledge with their colleagues. The findings include 7 key topics that should be designed into an Information System to maximize knowledge sharing within an organisation.

This research is important in that by addressing the problem it allows for more knowledge to be accessible and to be created within the organisation. This helps to

enable better decision making and stimulate innovation and growth, to name a few benefits.

In terms of scientific contribution, the expected results of this research will further advance gamification as a concept, how it can affect the work environment and whether it can be applied to an organisational system to improve employee motivation to share knowledge.

Keywords: Gamification, motivation, knowledge sharing, knowledge transfer, design science research, goal question metric, teams, organisation

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"The adventure of life is to learn. The purpose of life is to grow. The nature of life is to change. The challenge of life is to overcome. The essence of life is to care. The opportunity of life is to serve. The secret of life is to dare. The spice of life is to befriend. The beauty of life is to give."

(William Arthur Ward)

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GLOSSARY

SDT	Self-Determination Theory is a theory of motivation that represents a broad framework for the study of human motivation and personality.
Gamification	It is defined as the use of game design elements in non-game contexts
Knowledge transfer	This is the same as knowledge sharing and often confused with knowledge management. Knowledge sharing is the methodical replication of the expertise, wisdom, and tacit knowledge of skilled employees into the heads and hands of their co-workers.
IS	Information Systems refers to a collection of multiple pieces of equipment involved in the dissemination of information. This includes hardware and software.
MDA	(Mechanics, Dynamics, and Aesthetics, the developer creates the game and the player consumes the game. MDA helps understand this process and describes how to do this process using game mechanics, dynamics and aesthetics.
GQM	Goal Question Metrics: An approach for creating a (goal-orientated) measurement model
CT	Critical Theory: a research methodology
CR	Critical Realism: a research methodology

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The rate of technological advancement is increasing at an unprecedented speed, forcing organisations to adapt and learn at an even faster rate. It is important to energise people to continuously learn within organisations as this is the key to success (Serrat, 2017). Sharing knowledge drives organisational learning. While technology advances, organisations need to emphasise and develop a culture of knowledge sharing, rather than knowledge hoarding. Organisations should introduce special training programs that teach managers how to encourage knowledge sharing within their teams (Men, Fong, Luo, Zhong and Huo, 2019). Managers need to demonstrate the importance of sharing knowledge by motivating their employees and providing a safe, constructive environment to do so.

Motivation is a popular area of research where numerous motivational theories have been designed over the years. It has included understanding how to motivate employees effectively and how to tap into that motivation to accomplish work goals. People are constantly adapting because of technological changes, and it is important for managers to adapt their management approach too**.** Ristic, Qureshi and Selakovic (2017) state that satisfied and motivated employees are more productive, more efficient and contribute more to the fulfilment of organisational goals. When managers neglect to motivate employees, the employees will contribute little to their job and produce lower quality work, negatively affecting the survival and longevity of the organisation (Obiekwe, 2016). Knowledge sharing helps managers to promote the skills of employees (Jilani, Fan, Islam and Uddin, 2020) and thus positively affecting their performance. To do this, the proper infrastructure needs to be in place. Information Technology (IT) systems are not adequately supporting the storage and the sharing of knowledge (Bloice and Burnett, 2016). As well as the infrastructure, a lack of motivation from employees can also be an obstacle to successful knowledge sharing (see Sannicolas-Rocca, Schooley and Spears, 2014; Susanty and Wood, 2011; White, 2013).

While digital games have become increasingly popular over the last few years, research in psychology has further given evidence for their motivational appeal (Mekler, Brühlmann, Tuch and Opwis, 2017). Research has started looking at applying the motivational potential of games to a variety of other non-gaming contexts to help encourage user engagement. This practice is becoming well known under the term “gamification”, which is most commonly defined as “the use of game design elements in non-game contexts” (Deterding, Dixon, Khaled and Nacke, 2011).

This study will look at how to use gamification to motivate for knowledge sharing within an organisation across disparate teams and their effect on motivation. By looking at how self-determination theory works to motivate people, the study will design a prototype to motivate for knowledge sharing as part of the Design Science Research methodology.

1.2 Research problem

Knowledge sharing within organisations promotes internal learning which improves the quality of product innovation and the overall work performance (Gao and Bernard, 2018). When there is little to no sharing of work-related knowledge, it can cause poor organisational decisions and prevent innovation and growth.

Managers do not put enough emphasis on the importance of knowledge sharing within organisations, nor do they create a sufficient organisational structure for effective knowledge sharing to occur. This is primarily because of factors such as a lack of time or understanding (Andreasian and Andreasian, 2013; White, 2013; Khoza and Pretorius, 2017). The sharing of work-related knowledge will only take place when managers initiate and motivate for it (Javadi, Zadeh, Zandi and Yavarian, 2012; Obiekwe, 2016; Gunjal, 2019). Cerasoli, Nicklin and Ford (2014) concluded that organisations do not understand how to motivate employees and that some have inversely demotivated them by trying to implement knowledge sharing structures that fail to motivate them individually.

These organisations also fail to pay attention to factors that influence individuals' motivation to share knowledge, such as diversity, and personality traits (Poojita, 2013; Ristic, Qureshi and Selakovic, 2017). Employees may be unmotivated to share their knowledge out of fear of losing what separates them from others, out of fear of losing power within the organisation, or from fear of reducing their opportunities for personal success (Koskenkari, 2014; Akgün, Keskin, Ayar, Okunakol and Zeki, 2017). They may also be too afraid to express what knowledge they have if their managers appear to know less than the employees (Wojciechowska-Dzięcielak, 2020). Those that are happy and motivated tend to be more productive, more efficient at their job and contribute more than others.

Therefore, organisations and managers need a system that will encourage and motivate individual employees to share their work-related knowledge in a safe constructive manner, as well as be able to find and process available knowledge. This study will bridge the gap and lean on the views of Mekler, Brühlmann, Tuch and Opwis

(2017) by creating a system and applying gamification as a motivational tool that will encourage and motivate for knowledge sharing.

1.3 Objectives

The goal of this study is to improve employee motivation by designing a gamified system that encourages employee participation to share knowledge within their team and others.

To achieve this goal, the following objectives are set:

1. To determine how various gamification elements affect employees' motivation to share knowledge
2. To determine how motivation for knowledge sharing is affected across teams and within teams
3. To develop a prototype of a gamified system for knowledge sharing in an organisation
4. To evaluate the effectiveness of the gamified system to motivate knowledge sharing in an organisation

1.4 Research questions

The main research question for this study is:

How can gamification help affect employee motivation to share knowledge in an organisation?

The following are the sub-questions:

1. What is the impact of gamification elements on employees' motivation to share knowledge?
2. How is motivation for knowledge sharing affected across teams and within teams?
3. How can a prototype of a gamified system for knowledge sharing be developed for an organisation?
4. What impact does a gamified system have on employees' motivation to share knowledge?

1.5 Significance of the study

Considering how important knowledge sharing is towards organisational growth, the findings of this study may benefit any organisation looking to improve overall performance. With the ever-increasing change of technology, it is important to consider using simple, yet effective technology for processing and disseminating knowledge

between employees. This study identifies a product solution, connecting two separate fields of study, namely gamification and knowledge sharing. The product aims to promote strong organisational growth utilizing constructive knowledge sharing. The outcome of this study is a prototype of a knowledge-sharing system solution that can be implemented within an organisation, specifically an I.T related organisation, to motivate for knowledge sharing. The artefact makes use of gamification as a motivational tool, showing how a gamified software focussed on sharing knowledge may affect employees in the organisation. The artefact in this study also looks at motivating for knowledge sharing between employees and between teams.

1.6 Research methodology

The aim of this study is to focus on addressing and expanding on an existing problem, regarding motivation in the corporate environment, and providing a new solution to help improve motivation. Applying an IT approach, Design Science Research is the chosen methodology. This methodology makes use of several chronological steps that are applied to answer the questions and achieve the goal. Within Design Science Research, data other than the literature will be collected through two sets of questionnaires.

For the first set of interviews, twenty participants from the context organisation were involved in answering a metric based questionnaire. The questionnaire was divided into sections to allow ease of use and readability. It is derived from previous research to ensure it is valid and has been previously tested.

The second set of interviews consisted of ten participants from the organisation. As part of each interview, the participant was given an in-depth explanation of the prototype and an overview of the study being conducted. Each participant rated the prototype by means of a metric based questionnaire, which formed part of Goal Question Metric (a means to measuring software metrics). Each one of these interviews were scheduled for one-hour sessions.

Chapter 3 introduces the reader to Design Science and how it was used in this study.

1.7 Context organisation

The following study involved participants from an I.T based organisation. The organisation is a privately owned company, where their core business is software development and subsequent commercialisation of technology-based products. At the time of collecting data for this study, there were around 80 employees. They are an

international business, with six teams in South Africa (excluding employees from management). This study looks at three of these teams.

1.8 Research paper structure

The following study is organised into six chapters. The chapters are as follows.

Chapter 1 begins with an introduction to the study, detailing the research problem, aim, objectives and the methodology approach.

Chapter 2 presents a review of the literature. It focuses on three sections, namely knowledge sharing, motivation, and gamification.

Chapter 3 details the proposed research methodology, the approach, the strategy, data collection, data analysis, and ethical considerations.

Chapter 4 reports the empirical results of the study. It discusses the results in trying to achieve the objectives of the study.

Chapter 5 provides the reader with a discussion of the results, how they answer the questions and achieve the overall research goal**.**

Chapter 6 concludes the study and provides recommendations for future research.

References: contains all references to support the study and to acknowledge the work of others.

Appendices: in this section, all supporting documents that help validate the study are included here.

1.9 Delimitation

The following points are the identified delimitations that define the boundary of this study. These exclude delimitations such as the chosen research problem.

- Case study of one organisation within the I.T sector from South Africa, Cape Town
- From the context organisation, the study will involve 20 participants (1/4 of the organisation at the time of writing)
- Participants will be from three separate teams that are in the same office building and not internationally separated
- The study will collect data only through applying Design Science Research. Other methodological approaches considered for this study included Action Research.

1.10 Chapter summary

In this chapter, the researcher introduces the problem, identifies a possible solution, and discusses how that solution is developed and evaluated. The problem identified through literature is that organisations fail to motivate employees to share their work-related knowledge across teams within an organisation for a variety of reasons. The solution proposed is to develop a gamified knowledge sharing application that encourages employees to participate in knowledge sharing activities by means of gamification. The chapter details how Design Science research as a methodology is used to evaluate whether gamification can be applied to motivate for knowledge sharing. The importance of knowledge sharing, motivation and gamification are described in the next chapter.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Chapter 1 introduces the reader to the study's problem where managers fail to implement a knowledge sharing system that will encourage and motivate individual employees to share their work-related knowledge, as well as be able to find and process available knowledge. The following chapter reviews current and relevant knowledge of three identified topics that are pertinent to this study. The three topics will fall under the following headings within this chapter:

- Knowledge sharing
- Motivation
- Gamification

The following chapter will synthesise, summarise and critically evaluate each topic, further advancing the readers understanding of the study's background and problem, as well as provide a solid foundation for upcoming chapters.

2.2 Knowledge sharing

There are various ways to define knowledge sharing. At the simplistic level, it is the exchange of information, data, and expertise to solve specific problems or to gain new insights on a specific topic (Jilani et al., 2020). It can be described as the willingness of an employee to share their knowledge (Trivellas, Akrivouli, Tsifora and Tsoutsa, 2015) or as the process of mutually trading knowledge and creating new knowledge collectively (van den Hooff and de Ridder, 2004). Knowledge sharing is a behaviour that involves sharing ones' work-related expertise with other employees resulting in an increase in the organisation's effectiveness. Every process of knowledge sharing will involve both bringing (donating) knowledge and getting (collecting) knowledge (van den Hooff and Bart, 2004). Knowledge donating is defined as communicating knowledge to others, and knowledge collecting as consulting others for their knowledgeable information.

During the 1980s, Porter and Millar (1985) first discussed how information could be utilised to achieve a competitive advantage. In the 1990s, academics began to theorise that instead of capital, knowledge would develop to be the new source of wealth in organisations within the economy. This transition is certainly taking place.

Knowledge is a vital asset for organisations to have in order for them to stay competitive in today's world (Gao and Bernard, 2018). Hau, Kim, Lee and Kim (2013) stress how knowledge is key to an organisation's success, especially in today's

environment. By having knowledge, it allows an organisation to learn from their mistakes while keeping their employees empowered within the organisation. Knowledge sharing within an organisation can assist in gaining this competitive advantage by optimising the way in which they store the knowledge, how they share it, and how they use it.

2.2.1. Knowledge and information

"Knowledge" and "information" are two terms that researchers often use to mean the same (e.g. Wang and Noe, 2010). However, these two entities are different and one should define them separately. Information gives meaning to raw data by way of relational connection and often refers to processed data about someone or something. Knowledge is information processed by individuals. This includes facts, ideas, judgments and expertise related to an individual, team or an organisation. Andriessen (2006) describes knowledge as consisting of insights, interpretation and information as a collection of facts and figures.

In the context of knowledge sharing, knowledge refers to useful information gained through learning and experience. Khvatova and Block (2017) describe knowledge to be based on the conversion of data into information by context, and when the information is converted into an action, it then becomes knowledge. Knowledge is a valuable bit of content that if shared and used correctly, may improve the strength and competitive advantage of an organisation (Wojciechowska-Dzięcielak, 2020).

2.2.2. Knowledge sharing in organisations

When effective knowledge sharing takes place, it promotes learning within organisations and between individuals (Gao and Bernard, 2018). This improves the quality of product innovation and increases the speed at which it is developed. Knowledge sharing provides the team or individual with the opportunity to create new ideas and to improve upon their work performance. This, in turn, is beneficial to the organisation itself. It is seen as one of the key intangible assets in an organisation (Wojciechowska-Dzięcielak, 2020). Knowledge sharing is responsible for increasing co-ordination as people tend to get more comfortable with each other when they are working together to share knowledge.

Studies performed on organisations and their ability to share knowledge have proven that it enhances their performance, this includes their capacity to absorb information and its capability for innovation (Hau et al., 2013). However, the motives involved in the behaviour of sharing knowledge are still difficult and complex to understand and therefore this benefit does not always happen. The main reason for this is because the

behaviour to share knowledge goes against human nature, and people often think that their knowledge is more important (Chumg, Seaton, Cooke and Ding, 2016).

Creating knowledge sharing procedures requires thoughtful and careful management (Snyman, 2003; Cepal, 2010). The greatest challenge in creating a successful knowledge-sharing environment remains the participants' willingness to share knowledge with other participants (Chumg et al., 2016). Secondly, there are managers who rely on thinking that by adding technology the correct knowledge sharing behaviour will occur. Numerous organisational Information Systems are used only out of requirement, and not for their charm (Matallaoui, Hanner and Zarnekow, 2017). This leads to demotivation, undesirable behaviour, and lower acceptance of the system.

Organisations also fail to achieve their knowledge sharing objectives because of a lack of a distinct connection between their knowledge sharing initiatives and the organisations' objectives. Riege (2005) asserts how this may be a result of organisations seeing knowledge sharing as a separate activity altogether.

Creating and applying new knowledge (both tacit and explicit) is important to most companies, regardless of which sector they may be in. One reason for the importance of sharing knowledge is that it provides a continuous cycle of innovation, which, in the long-term, strengthens an organisation's competitive advantage in the economy (Gurteen, 1999).

2.2.3. Tacit and explicit knowledge

Researchers have studied employees' knowledge sharing intentions; however, some of these studies fail to differentiate and distinguish the various types of knowledge shared between employees. Choo (1998) describes three types of knowledge: tacit, explicit and culture. Boisot (1998) describes predominant knowledge types as personal, proprietary, public knowledge and common sense. Other authors describe how tacit or explicit knowledge is what is shared among employees in knowledge sharing (Nonaka, 1994; Reychav and Weisberg, 2009). Overall, tacit and explicit knowledge are what most researchers focus on regarding knowledge in the organisation.

Polanyi (2009) clarifies tacit knowledge as "knowing how to do something without thinking about it", and how it is about knowing more than what we can articulate. A good example would be like riding a bicycle. This type of knowledge is subjective and highly personal. It contains personal wisdom and experience that is context-specific. It is more difficult to codify and extract and often sits in the minds of the employee (Razmerita, Kirchner and Nielsen, 2016). This knowledge also includes persons' insights and their intuitions. Tacit knowledge can also include someone's opinions,

their take on a specific matter, their technical skills, and their knowledge (Magnier-Watanabe and Benton, 2017). Tacit knowledge is a relative concept, what one employee expresses may be hard to interpret by another employee. In terms of competitive advantage, tacit knowledge is more valuable in achieving this and the reason why it is important to capture.

Explicit knowledge is documented information that can make actions easier and is easily identified, shared and utilised. Explicit knowledge is data that is technical, which can be translated in a formal language like manuals, mathematical expressions, copyright and patents (Preece, Smith and Moodley, 2007).

It should also be noted that as opposed to tacit knowledge, it is easier to share explicit knowledge (Hau, Kim, Lee and Kim, 2013). This effectively means that tacit knowledge sharing is more effort-intensive.

It is important that an organisation capture the knowledge and experiences of an employee in order to change their tacit knowledge into organisational knowledge. This way they can use the knowledge that is inside an employee's head even after they have left, or retired.

2.2.4. Organisational knowledge and a knowledge sharing culture

All organisations have cultures. These are sets of values and norms, which together guide the behaviour of the employees. While neither good nor bad, cultures that inhibit knowledge are one of the more prominent barriers to successful knowledge sharing. Culture is important because it can have a solid influence on human behaviour (Smith and McKeen, 2003). The culture of an organisation can influence many other parts without being obvious (such as who they recruit, how people interact, the software they are permitted to use, and the allowed informal conversations that may take place), and is an overarching mechanism. Figure 1 shows how culture overarches and constrains all other aspects of organisational life, defining boundaries to what is sought after, possible and practical to do. Organisational culture is one factor that heavily affects the transfer of knowledge and the shaping of knowledge sharing behaviour among people (Abbasi and Dastgeer, 2018).

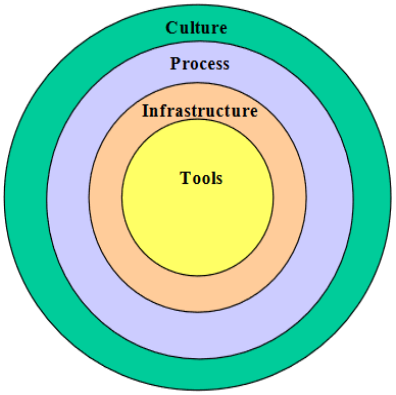


Figure 1: Culture influences activities in all fields of organisations (Smith and McKeen, 2003)

Therefore, organisational culture will affect its knowledge sharing initiatives and will influence employees towards a set of behaviours in knowledge sharing. Creating a knowledge sharing culture is about making knowledge sharing within an organisation the norm. It is where people openly share knowledge, where they are willing to impart knowledge on others and where ideas may flow without restrictions. Successful knowledge sharing initiatives within an organisation need to focus on people-orientated aspects such as attitudes and cultures (Khvatova and Block, 2017). In order for this culture to develop, employees need to be encouraged to collaborate and share with one another.

To show the importance of culture in knowledge sharing, Smith and Mckeen (2003) acknowledge four reasons why:

1. Culture helps in defining what knowledge is important
2. Culture helps distinguish and build a relationship between organisational and individual knowledge
3. Culture helps in creating new knowledge
4. Culture helps create an understanding of what knowledge is sensitive, how much to share, and which actions to reward/punish

An employees' motivation to share knowledge may come from their personal belief structures or from institutional structures, and in some cases both. Institutional structures are often described as "culture" and may include that of shared values, norms, accepted practices or other peoples' perceptions (Trivellas et al., 2015). When there is little to no knowledge sharing culture, it can result in employees feeling disengaged with managements' objectives. Employees may begin to feel isolated and not part of the collective team responsible for driving the organisation forward. This may lead to them becoming resistant to new ideas.

So while technology helps knowledge sharing and makes knowledge sharing initiatives possible, implementing it without regarding factors such as culture will only reinforce existing behaviour (such as knowledge hoarding). Simply implementing technology only will not suffice to encourage and drive knowledge sharing within the organisation.

2.2.5. Knowledge sharing barriers

Despite the growing significance of knowledge sharing and knowledge sharing practices within organisations, there are several barriers that make it hard to achieve its benefits and achieve maximum efficiency. Researchers categorise these barriers, such as personal, organisational and technological barriers. Smith and Mckeen (2003) include managerial barriers. Riege (2005) describes over thirty barriers that managers need to be aware of when implementing knowledge sharing practices and to help improve the overall effectiveness of it within an organisation.

Individual (social) barriers relate to factors such as improper communication between colleagues, a lack of time, or differences in national culture. The most common barrier discussed in many research papers (e.g. Bloice and Burnett, 2016; Gunjal, 2019) is peoples' lack of dedicated time towards knowledge sharing activities. The effectiveness of an employee to share knowledge depends most importantly on their communication skills. Secondly, language, or the lack of understanding one's language, can affect or impede the knowledge-sharing process. Akgün, et al. (2017) discuss how the people who make little effort to participate in sharing knowledge are believed to be uninterested in their work. This could mean that they do not want to learn more, or cannot grasp it. When one party feels that they are not receiving enough knowledge in exchange for theirs, it can cause future hesitation to share knowledge.

Organisational barriers relate to factors such as a lack of proper infrastructure and resources in place, and the physical environment. This can also include a lack of proper leadership within the organisation. It requires leadership to drive the team or group of people. A lack of corporate culture towards knowledge sharing is also a form of an organisational barrier.

Technical barriers relate to factors such as peoples' desire not to use applications for specific reasons. It also relates to a lack of technical resources aimed at helping facilitate knowledge sharing.

While research has shown that people, by nature, naturally oppose sharing knowledge, Akgün, et al. (2017) state that there has been very little research into why employees in

teams are reluctant to share their knowledge with one another especially in technology-intensive service organisations.

Employee training, using the right technology and a proper structure are some of the ways to overcome some of the knowledge sharing barriers (Andreasian and Andreasian, 2013).

2.2.6. Knowledge sharing in teams

Teams are a common element used within organisations. Enhancing knowledge sharing within a team requires a certain level of trust, which is not only directed at the team leader but with the team itself. This describes group efficacy, which is the belief in the teams' ability to perform the objectives it needs to accomplish. An important underlying concept to this is reciprocal commitment (Chatenier, Verstegen, Biemans, Mulder and Omta, 2009), also known as the willingness of a team member to help another because that is what they would want from their team members. Research performed by W. Wang, Y. Wang and W. Chang (2019) concluded that trust (along with psychological empowerment) had significant "direct positive effects" on knowledge sharing intentions. Their research concluded that when employees in a team have more trust in one another, they tend to care about each other; this resulted in them being more willing to place more effort into sharing knowledge.

Team knowledge sharing is a noteworthy forecaster of team performance. Research into team knowledge sharing has shown that a few factors which decisively affect its performance include personality traits, team communication styles and knowledge sharing attitudes, interpersonal familiarity, structural diversity and diversity of team member expertise, and small team sizes (Lee, Gillespie, Mann and Wearing, 2010). Fitzpatrick and Askin (2005) concluded that the performance of teams not only relies on each member's technical competence but also depends on their individual behaviour and their interpersonal interactions. Men, Fong, Luo, Zhong, Huo (2019) research and conclude on how the act of sharing knowledge increases team creativity. It is very important for managers to take note of this to capitalise on the impact knowledge sharing may have, if they require high levels of creativity.

Knowledge sharing within teams and across teams does not happen automatically. It is the team leader who has the potential to strongly influence the degree of knowledge sharing (Lee et al., 2010). When team leaders perform tasks such as offering new ideas on a topic or stimulating new approaches to work they can instigate team talks, which can, in a sense, lead to team knowledge sharing. By sharing knowledge, team leaders set an example, which team members will reciprocate with others. Therefore,

the strength of the leaders' performance at performing the knowledge-sharing role, the better the level of knowledge sharing in the team will be.

Second to a strong leader, is team trust. On an individual level, team reliance on one another and the disclosure of sensitive information are two dimensions of trust (Lee et al., 2010). Trust in the team is just as important with knowledge sharing being affected by team members' beliefs and feelings about one another. Politis (2003) found that a greater conviction reassures team members to share their knowledge.

Teams located in separate physical locations can make the knowledge-sharing process challenging, if not impossible (Hong and Vai, 2008). One means of overcoming this physical dispersion is to use some technological fixes, such as advanced communication networks. However, this is not enough to address the issues satisfactorily. One of the biggest challenges cross-functional teams face is reluctance from team members to participate in knowledge sharing due to its complexity.

Lastly, for successful knowledge sharing to occur within a team and across teams, there needs to be trust in the teams' abilities, a learning climate where learning is encouraged, social cohesion where there is a connection and a sense of care between team members and a shared understanding among each other.

2.3 Motivation

For the successful sharing of knowledge, it is increasingly becoming clear that it depends on the employee's motivation to communicate with their colleagues and to learn from them (Lin, 2007a; Ardichvili, Page and Wentling, 2003; van den Hooff, Schouten and Simonovski, 2012; Bavik, Tang, Shao and Lam 2018).

There are numerous definitions for motivation, what is common amongst them all is how it defines motivation in terms of motive, the root word. Motive is something that causes a person to act. Behind all our actions that we do on a daily basis, there is a motive (Kuppuswamy, Saminathan, Udhayakumar, Vigneash and Gopalakrishnan, 2017). Motivation provides the reason for a persons' specific action, desire or need and is about getting a person to act on a situation.

2.3.1. Employee motivation in the organisation

Employee motivation raises employee efficiency (Ganta, 2014). While it is not strictly related, encouraging a balance between one's ability and one's willingness can achieve a higher level of efficiency.

Two important reasons as to why employee motivation is important, include them achieving their own personal goals and achieving the organisational goals. Highly

motivated employees are more beneficial to an organisation as they produce a superior-quality product and service as opposed to employees who are disengaged or unmotivated (Honore, 2009; Bharathi, 2017). Reducing turnover is one of the most important benefits of motivation and is the key to keeping employees.

If employees were to understand that sharing their knowledge may aid them in their job and help them in their personal development then knowledge sharing will become a reality (Preece, Smith and Moodley, 2007). Despite numerous case studies on demonstrating knowledge sharing in the work environment, some employees object to sharing knowledge (Hanan and Stemke, 2014; Webster, Brown, Zweig, Connelly, Brodt and Sitkin, 2008).

Within organisations, some employees feel that if they share their knowledge others may steal it, and loose credit for the work. Knowledge sharing is not about sharing everything you know and all your ideas. Nor is it about being open about absolutely everything. It is imperative an employee exercises their better judgment. Knowledge sharing is not only about sharing their best knowledge, but also about improving the way that other people work. An employee can share less utilised procedural knowledge, as they may have knowledge that they do not make use of on a daily basis. If they were to share this knowledge with others, their colleagues may be able to use the shared knowledge to their benefit. In return, they have the opportunity to further improve upon the shared knowledge for others to use.

2.3.2. Intrinsic and extrinsic motivation

The motivation to engage with certain tasks and activities differs from person to person, and while the exact understanding of motivation is still evolving (Zhang, Zhang, Song and Gong, 2016), most theories describe motivation in terms of either extrinsic or intrinsic.

Intrinsic motivation is the satisfaction and enjoyment a person receives when they perform an activity, often for their own interest and benefit (Deci, Connell and Ryan, 1989). Work engagement, task identification, positive affect, and employee productivity are some of the positive outcomes connected to this type of motivation (Kuvaas, Buch, Weibel, Dysvik and Nerstad, 2017). Therefore, a person is motivated to perform an activity for the sake of it, and the reward is a sense of accomplishment. Examples of intrinsic motivation could include reading to learn about a new subject or hobby; going to the gym to relax; taking on extra responsibilities at work for the satisfaction of knowing you are trusted to do so.

The intention of extrinsic motivation is to achieve positive consequences, which could include incentives (positive) or consequences (negative) such as punishment (Deci and Ryan, 2004). This means they are motivated to earn a reward or to avoid punishment. Extrinsic motivation is motivation by means of an external force acting on the person to perform an activity. Examples include going to the gym to lose weight; studying to prepare for an upcoming exam; being asked to complete overtime at work because a deadline is approaching.

Both extrinsic and intrinsic motivation promotes performance gains for employees. They can have different effects on how an individual pursues their goal. One of the greatest intrinsic rewards for many people is having a purpose at work, or finding meaning in what they do at work (Smith and Popa, 2015). This is why intrinsic rewards are an ideal motivator of games in the work environment.

Amabile, DeJong and Lepper (1976) discover that external factors will decrease intrinsic motivation, this includes factors such as deadlines, which restrict and control an employee. Deci and Ryan (2002) concur with this and add how extrinsic rewards (for example, money) replaces a persons' intrinsic motivation over a period of time. When introducing incentives, the focus should be on long-term effects (Friedrich, Becker, Kramer, Wirth and Schneider, 2020). These authors argued that rewards would decrease individuals' succeeding motivation. However, It is seldom debated whether information about players' long-term interaction and failure rates with the preferred behaviour occur.

Therefore, an organisation should focus on increasing an employees' intrinsic motivation foremost, second to providing rewards. They should aim to provide work autonomy, constructive feedback and provide competitive base salaries (Kuvaas et al., 2017). When people feel they have a purpose in the work they do, it can be a strong motivator.

2.3.3. The use of rewards in organisations to motivate people

Organisations often use rewards to encourage motivation amongst employees (Niemi and Pellas, 2009; Ganta, 2014). Throughout time, people have been using rewards to change behaviour. For example, soldiers may have their accomplishments rewarded through rank changes and/or badges, children are taught by means of rewards and punishments and schools use grading systems (Nicholson, 2015). The biggest problem with handing out rewards in a reward system like these is that the rewards must continue.

By using a technique called operant conditioning developed by Skinner (1965), the timing of when rewards are handed out can be delayed. An example of where this is used is in casinos. They use operant conditioning to entice and addict people to play constantly without rewarding them every time. Think of gambling machines, which seldom hit jackpot. This same principle can be used within an organisation, and in some cases, have already been implemented. It is to be noted that when these rewards end, the behaviour will stop too unless the person has found another reason to continue the behaviour (Nicholson, 2015).

For many employees, the only reason to perform a difficult task is if they receive a financial reward. If this reward were to stop, so will their effort on the specific task. For others, they have found their own personal reason to enjoy their work. If the monetary reward stopped (perhaps become less important in their life) they would continue to perform their job (Nicholson, 2015). In the book 'Punished by Rewards' written by Kohn (1999), he documents multiple studies that indicate how people accomplish tasks more poorly when doing it for a reward (examples include teachers handing out stickers, p.23; In IBM "when people receive a performance evaluation poorer than they think appropriate, ... may react by producing at even lower levels in the future", p.136). When they have received the reward, they are less likely to do it again (Nicholson, 2015). Applying a monetary reward to attempt to address an immediate problem is a quick solution rather than a long-term sustainable solution.

There are other techniques organisations can implement to motivate their employees. Different factors influence employees in different ways, and therefore managers need to use initiatives that encompass multiple techniques.

2.3.4. Motivation theories

Since as early as the 1950s, researchers have been studying human motivation. Motivation is one of the most frequently researched topics in organisational behaviour. One reason for its popularity still to this day is revealed by a study done by Gallup (2017), which states that 56% of employees (in America) are not engaged in the work they do. This costs the company 34% of their salary.

Motivational theorists have explored different possibilities of motivation. These theories aim to improve motivation, and in order to improve motivation by using gamification, a suitable theory needs to be applied. Some of the most prominent approaches that have shaped our understanding of motivation and its effects include Maslow's hierarchy of needs and Hertzberg's two-factor theory.

Taking into account the wide variety of motivational theories, this study will focus on applying self-determination theory (SDT). SDT is debatably the most commonly used psychological theory in gamification research that is currently being used to date (Nacke and Deterding, 2017) and is currently the most relevant motivational theory for this study as well.

2.3.4.1. Maslow's hierarchy of needs theory

In 1943, psychologist Abraham Maslow published the Hierarchy of Needs. The basis of his theory was that there are five levels of needs; or alternatively defined as five sets of goals which can be called basic needs (Maslow, 1943). These basic goals are related to one another (Maslow, 1943). By fulfilling each level, this would allow a person to be motivated by higher-level factors (Ganta, 2014).

In terms of the workplace, it would not be possible to motivate an employee with positive feedback (esteem) if not first meeting their physiological needs. You could not expect to have an employee engaged in completing organisational goals if they are not able to provide food for their family, or if they lack shelter, for example.

Managers will do what is required to satisfy employees' needs. In general, people starting their career tend to concern themselves with physiological needs, such as safe work environment. After this, the employee will want his belongingness needs to be met. Following this, employees will want his higher-level needs of esteem and self-actualization met. By meeting these needs, they are motivated and engaged in their work.

Table 1: Maslow's hierarchy of needs

Level	**Type of Need**	**Examples**
1	Physiological	Food, water, shelter, sleep
2	Safety	Personal, emotional, financial, health safety
3	Love/belongingness	Friendships, family
4	Esteem	Getting recognition, self-respect
5	Self-actualisation	Realising ones full potential. Seeking happiness

Maslow's hierarchy has been widely used among managers because it is easy to understand and to implement in the workforce.

2.3.4.2. Herzberg's Two-Factor theory

Herzberg in 1959, after Maslow's theory 1943 (and loosely based on Maslow's hierarchy of needs), developed a two dimensional model of factors that could affect people's attitudes about the work they do. It argued that certain job factors cause job satisfaction, and other factors cause dissatisfaction, which could mean job satisfaction and job dissatisfaction act separately of each other. It also explained how intrinsic factors are related to job satisfaction (motivation) and extrinsic factors are associated with job dissatisfaction.

The theory distinguishes between motivators and hygiene factors (dissatisfiers). Examples of motivators include challenging work, responsibility and, recognition. Examples of hygiene factors include salary, job security, job benefits, and company policy. When hygiene factors do not exist within the organisation, employees will be dissatisfied, and if they do exist, it does not mean the employees are motivated. This is because the opposite of motivation is demotivation only semantically and not when trying to understand the behaviour of employees in their jobs (Kiruja and Elegwa, 2018). According to Herzberg (1965) once these hygiene factors are met the organisation should then next focus on providing opportunities to learn and grow.

Extrinsic motivators (salary, bonuses) are expected and therefore will not improve motivation but will rather cause dissatisfaction when missing. Managers must be concerned with the type of work the employee does, and the opportunities it presents. Managers, however, see the hygiene factors as ways to motivate employees, when in fact they do little for motivation. Hygiene factors are factors that lead to job dissatisfaction.

As an example, if an employee were underpaid it would likely be that they would not be motivated until the organisation makes an offer of better pay. In addition, if an employee, who is paid well, receives a pay increase it would not have a lasting motivational effect (Ganta, 2014).

2.3.4.3. Self-determination theory

Human beings need to feel that what they do is enough and will be successful. This means that to operate fully in their environment they need to experience a sense of competence. This also means that they need to feel socially safe (the need for relatedness is satisfied). As a result of feeling safe, they are more likely to become autonomously motivated (Deci and Ryan, 2014). Previous research has shown that autonomous motivation can promote knowledge sharing behaviour (Gagné, Tian, Soo, Zhang, Ho and Hosszu, 2019).

Self-Determination Theory (SDT), a motivational framework, suggests that intrinsic and extrinsic motivation both have their own way of shaping how people behave and why they do so. While extrinsic motivation includes sources such as employee evaluations, awards, and respect from other team members, intrinsic motivation includes internal efforts that motivate people to behave in a specific way. SDT describes motivation as a range, where on one side lies no motivation (amotivation) and on the other end lies intrinsic motivation. In SDT, extrinsic motivation lies between these two.

By building upon a person's intrinsic motivation, this can promote a positive behaviour. As opposed to constantly providing some variation of rewards in reward-based initiatives, managers can create a structure that helps employees find their own internal reasons for interacting with the necessary behaviour. This is the premise of the theory of Self-Determination developed by researchers Deci and Ryan (2009).

As opposed to other motivation theories, seldom are people driven by only intrinsic or extrinsic motivation alone, but rather by a combination of both. People are complex, with each person being unique in their goals and ideas. SDT also identifies the importance of external sources and that extrinsic and intrinsic motivation is of equal importance. Both of these types of motivation drive people to meet three basic needs. The three main intrinsic needs, competence, autonomy, and relatedness, shown how they connect in Figure 2, can be summarised as follows:

Competence

Competence is whether participants are able to produce outcomes that are expected of them and to experience mastery as well as a feeling of effectiveness from producing desired outcomes. Competence is about enabling participants to have control over their own lives by making the choices they want.

Relatedness

Relatedness is the feeling of being connected and not isolated from other participants.

Autonomy

When a participant chooses their own path to follow, this is Autonomy (Nicholson, 2015), the system allows participants freedom of decision. Autonomous motivation consists of intrinsic motivation and two types of extrinsic regulation which are integrated and identified regulation.

SDT emphasises how individuals instinctually grow towards positive motivation, while only if their basic needs are fulfilled (Deci and Ryan, 2002). Yoon and Rolland (2012) note that while motivation theories, such as SDT exist; it hasn't been actively utilised as a research framework in knowledge-sharing.

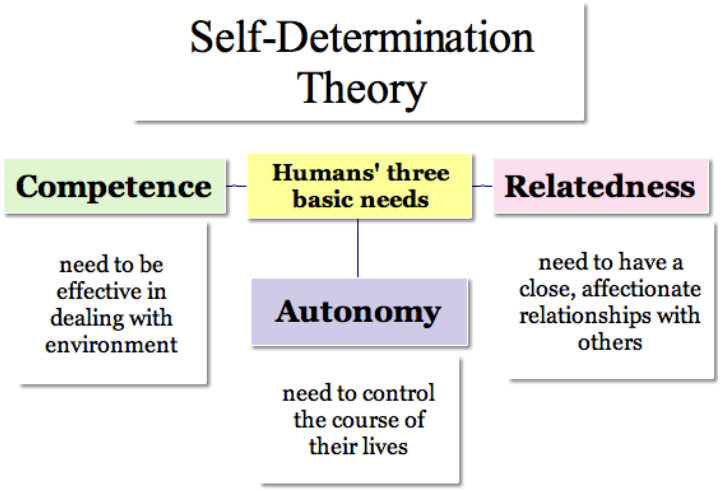


Figure 2: 3 basic needs of SDT (Deci, 2009)

2.4 Gamification

Gamification looks at applying elements and characteristics of video games and applying it to everyday actions. It refers to the design of software in non-game contexts using design elements from games (Deterding et al., 2011). It applies features connected with video games, which includes game mechanics and game dynamics (Simões, Redondo and Vilas, 2013). The intention for this is to motivate desired behaviours and create a playful and enjoyable gameful user experience. According to the conceptualization, there are the following parts to it: (Hamari, Koivisto and Sarsa, 2014):

1. The applied motivational affordances (game elements such as badges, points, leader boards)
2. The psychological outcomes, referring to the psychological experiences (enjoyment, fulfilment)
3. The further behavioural outcomes, those behaviours that are supported by the gamified system (e.g. increased sharing of knowledge)

After the success of Foursquare, motivating and increasing user activity by means of using game design elements rapidly gained momentum under the term gamification (Deterding et al., 2011). Today numerous organisations offer some form of gamification within their offered services. Some examples of gamification include:

- Nike developed an application called NikeFuel where users compete against each other in daily physical activity. Similar to Fitocracy, this is an example of one of many popular implementations of gamification in the fitness and health category.

- ChoreWars is a fun-filled way to boost motivation at the office or at home with the family, to complete mundane tasks that simply need to be done.
- Starbucks is an example of gamification in the loyalty rewards program category. It rewards users with stars for each order placed. Other examples in this category include Pick ‘n Pay Smart Shopper, Woolworth’s rewards and Clicks ClubCard.
- Duolingo is a language learning platform and an example of gamification in the education category. If the student completes certain tasks within the given time, they earn points. It teaches people to learn by applying gamification. Other examples include Codecademy, a service that teaches users how to code.

By applying gamification to Information Systems, it allows for the same experiences and motivations that games have, which consequently attempt to affect the users' behaviour. Woźniak (2017) states that a precise definition of gamification is lacking, while Koivisto and Hamari (2019) discuss how gamification to still in its infancy but is rapidly developing.

2.4.1. Successes in gamification

The term gamification, originating in the digital media industry, was not commonly used until the latter half of 2010, and only since then has the term grown and developed as a concept to be used (Deterding et al., 2011). There are still new terminologies of gamification being created. Some alternative terms include “productivity games”, “funware”, “playful design” and “surveillance entertainment”.

Gamification has become a talking point for many researchers and experts in the industry (Deterding, 2012; Hamari, Koivisto and Sarsa, 2014; Seaborn and Fels, 2015). While the hype around gamification is still high, it is a highly contested term. Early researchers have reported failures with gamification initiatives (Swacha, 2015). With discontent over the current implementations, oversimplifications, and interpretations, some researchers have coined different terms for their own arguably related practice (Deterding et al., 2011). Bogost (2013) also defines it as an oversimplification of games designed for the purpose of easy profit.

To counter these negative reports, there are numerous success stories that show the positive effects of gamification within applications that stretch from education, self-management, innovation, employee engagement, crowdsourcing and marketing, medicine and air flights (Huotari and Hamari, 2012; Wang and Noe, 2010). Nacke and Deterding (2017) describe how these researches are contributing to the maturation of

gamification, and how it is taking a step forward in developing it as a concept that can be used in various industry types.

Researchers have discovered that organisations must avoid jumping-on-the-band-wagon and quickly implementing gamification to coerce behaviour and outcomes they want. They should rather take the time to understand the reasoning of gamification paying attention to their business objectives and employee motivations.

2.4.2. Gamification elements

There are numerous studies connecting gamification principles to improving motivation and thus linking gamification to performance in the working environment. However, a study conducted by Hamari (2014) on 24 empirical studies showed that the effectiveness of a gamified system largely relied on the applications background and the users for which it is intended for. In effect, this implies that there is no one-size-fits-all approach to gamifying a system with gamification elements.

The top gamification elements often associated with gamification (e.g. Mekler et al., 2017) include:

- Points (score, XP)
- Leader boards (ranking)
- Badges (achievements, medals, trophies)

Essentially, in its most basic form, points measure how well a participant is doing right at the current time, which serves them feedback on their status. Points fit “an instant reward” concept (Swacha, 2015), which can highly motivate a person, in the short term.

Leader boards let participants of the gamified system compare their achievements against others. Leader boards are crucial to creating a competitive environment as it shows the participants progress relative to the progress of others.

Badges depict participant’s achievements visually. They can serve as a goal-setting tool, which can help new participants understand what is achievable within the system. This has a strong motivational potential (Swacha, 2015).

Mekler (2016) cautions to game designers against over-relying on badges, leader boards and points, saying that these are the least essential in actual games. One of the reasons for this is that they are responsible for diminishing participants’ intrinsic motivation in both game context and non-game contexts. He also admits that there is a lack of empirical evidence on whether this is true, and under what conditions intrinsic

motivation will be negatively affected by these game elements (and how it will affect intrinsic motivation).

Other typical gamification elements include:

- Challenges, quests, tasks (that participants have to achieve to advance)
- Missions (predefined sets of challenges)
- Levels (showing a participants' progress in a more general way than points)
- Social networking features
- Avatar, character, virtual identity
- Timer, speed
- Real-world/financial reward
- Cooperation, teams (participants working together in groups as opposed to on their own thus building trust, an important factor in ones' willingness to share knowledge)

Matallaoui, Hanner and Zarnekow (2017) talk about how principles such as continuous feedback, provision of long/short term goals, progressive rewarding, and an unanticipated rewarding mechanism should be thought of when creating a gamified system. In order to apply such principles, it is important to understand the popular Mechanics, Dynamics and Aesthetics (MDA) framework developed by authors Hunicke, LeBlanc and Zubek (2004).

The terms "gamification" and "rewards" have over time, become synonymous with each other (Nicholson, 2014), where many variations of gamified systems focus on external rewards. The implementer of the gamified system decides what the most favourable actions are, and assigns points for these behaviours. Over time as the players earn these points, it will lead to some form of intangible status or a tangible status that connects to the real world. This type of reward-based gamification is relatively simple to implement, demonstrated by multiple researchers throughout the past decade. Badges are a way of allowing a person to show their success and their achievements within the Information System.

2.4.3. MDA framework

The MDA framework defines gamification in terms of three concepts, namely: mechanics, dynamics and aesthetics. Figure 3 illustrates how they relate to one another. It is a formal approach to understanding games and provides an understandable model on how gamification works (Kim, 2015).

Game mechanics describe the specific elements of the game. They can strongly affect participants' motivation and engagement with the system (Matallaoui, Hanner and Zarnekow, 2017). Common game mechanics include:

- points
- leader boards
- levels
- achievement systems

Game dynamics is the behaviour of game mechanics acting on the players' data entered for the duration of the gameplay life cycle (Hunicke, LeBlanc and Zubek, 2004). It is about how the game behaves when the participant interacts with the game dynamics and features. It is essential that game designers fulfil the most common desires of the various participants. They include:

- Rewards
- Status
- Achievement
- Self-expression (makes it easy for people to distinguish themselves from the rest, a way to overcome the knowledge hoarding barrier)
- Competitions
- Altruism

Aesthetics refers to the preferred emotional responses that are induced in the participant and can consist of (Hunicke, LeBlanc and Zubek, 2004):

- Sensation
- Fantasy
- Narrative
- Challenge
- Friendship
- Discovery
- Expression
- Submission

The aesthetics of the gamified system should represent the managements' desired goal.

Figure 3: MDA framework (Hunicke, LeBlanc and Zubek, 2004)

2.4.4. RECIPE for meaningful gamification framework

The fastest way to gamify a system is to add simple game elements such as points, badges, achievements and leader boards. Nicholson (2015) defined the process of adding these elements as BLAP gamification, which he describes as reward-based gamification. The reality is that this reward-based gamification only changes a players' short-term behaviour. Organisations and game designers should avoid rewards if they want to change their behaviour for the long run. Exceptions are when an immediate change needs to occur. If there is not a viable way to motivate a person intrinsically to perform a task, then reward-based gamification can be useful and often used.

Designers can use design elements that focus on promoting internal motivation as opposed to game design elements that focus on increasing external motivation by means of rewards and by understanding how to build intrinsic motivation using Self-Determination Theory. By doing it this way, the designer has created meaningful gamification. Nicholson (2015) developed six concepts for a more meaningful gamification experience that can improve participants' intrinsic motivation. They are:

- Play: the participant must be free to engage in the system and not forced to engage with it
- Exposition: allow users to create their own stories and provide them with real-world integrated stories
- Choice: give participants the ability to decide what to do (related to autonomy in SDT)
- Information: allow the participant the ability to learn and engage more of the system and its functions
- Engagement: giving participants the option to interact with others and learn from them
- Reflection: help participants find other interests they may have

Overall, when you develop the system to be enjoyable, the chances of users engaging with the system increase over the long run (Koivisto and Hamari, 2019).

2.4.5. Player types

There is a need for personalising gamified systems to the players' behaviours and characteristics because when the system is personalised it becomes more effective than a one-size-fits-all system. Each person is motivated differently and have their own personality, which is important to remember when creating a gamified system. Bartle (1996) wrote about four different types of video game players, which has created various education and learning-related works. Each of these categories represents a different kind of motivation. Most often, a single person may not fit in one category only, but in more than one, and during the course of the game, they may alternate between different archetypes. The four types are:

- Killers – these types of people enjoy the sense of competition and competing against others. Succeeding is the top goal they pursue.
- Achievers – they are focused on gaining levels and as many points as they can, ultimately reaching high levels and rankings.
- Socialisers – they use the system as a way to engage and connect with others, socially. The aspect of a community stimulates them.
- Explorers – Seek to discover the application and its boundaries.

In Figure 4 Bartle described how killers acted on other players, achievers acted on the world, explorers interacted with the world and socialisers acted with one another.

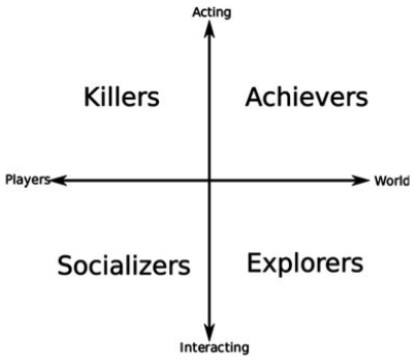


Figure 4: Four archetypes of game player types (Bartle, 1996)

While much of what Bartle described in his research remains true to this day regarding player types in games, it is outdated and not applied to the gamification context. It needs to focus on current human motivation or relate to recent theories of motivation such as the Self-Determination Theory. In motivation, SDT is understood as intrinsic or extrinsic. Three components support intrinsic motivation: competence, autonomy and relatedness (described in 2.3.4.3).

Tondello, Wehbe, Diamond, Busch, Marczewski and Nacke (2016) proposed a model, called the Hexad model, describing six gamification user types who vary in the degree to which they can be motivated by intrinsic or extrinsic motivational factors. **Error! Reference source not found.** shows how the user types relate to one another.

Figure 5: Hexad model of gamification user types (Tondello et al., 2016)

The six user types are:

1. Philanthropists: purpose motivated and altruistic.
2. Socialisers: relatedness motivated, desire to interact
3. Free spirits: autonomy motivated, desire to act themselves,
4. Achievers: competence motivated, desire to progress within a system by doing tasks
5. Players: rewards (extrinsic) motivate them
6. Disruptors: like testing the system, disrupt the system

Table 2: Recommended design elements (Tondello et al., 2016)

User type	Design element
Philanthropists	Knowledge sharing, gifting, admin roles
Socialisers	Teams, social networks
Free spirits	Exploratory tasks, Easter eggs
Achievers	Challenges, levels,
Players	Points, rewards, leader boards, badges
Disruptors	Anonymity, voting, anarchic gameplay

2.4.6. Applying gamification at work

Engineering gamified software is challenging and often only implemented within organisation specific teams (Morschheuser, Hassan, Werder and Hamari, 2018). Some of the benefits of applying gamification within a team system or in an organisational system include addressing problems such as high-stress levels, reduced loyalty, and swift changes in the workforce. A high level of stress can have a negative effect on employees, increasing their risk of diabetes, obesity and even addictions (Oprescu, Jones and Katsikitis, 2014). This is why it can be important to gamify aspects of work such as health and safety, by improving and assisting employees' productivity and wellbeing for the long-term. Increasing productivity at the organisational and personal level is the long-term aim of gamifying a place of work (Oprescu, Jones and Katsikitis, 2014). It is important for managers to understand what their goals are and what they aim to achieve with the aid of gamification.

Applying gamification to an organisational software system not only makes it more enjoyable for people to use, but it also increases the frequency that employees use the system. By increasing the number of times they use the system it ensures better facilitation of the underlying workflows (Morschheuser et al., 2018).

Oprescu, Jones and Katsikitis (2014) discuss 10 principles for transforming work processes by means of gamification. They discuss how to include gamification at work and how it depends on what the desired goal is of the organisation. For example, an employer would take a different approach to gamifying a system for adding amusement (fun elements) to gamifying a system for the wellbeing-orientation.

Applying gamification may increase an employee's short-term performance. However, in the long run, it can have a damaging effect on their motivation if not implemented correctly (Smith and Popa, 2015). Some organisations add gamification onto their regular work to get their employees to work harder by rewarding them for the extra work. Gamification should be applied to help expand employees' everyday behaviours and apply core skills to improve desired organisational behaviours.

One of the key characteristics of gamification is that all participants play voluntarily and that no one is forced. Secondly, when applying gamification in the workplace, game designers should instead of using prizes and rewards rather rely on the intrinsic motivation of altruism (Smith and Popa, 2015).

2.5 Chapter summary

To understand how gamification could help motivate for knowledge sharing the literature review was broken into three sections. The three sections are knowledge sharing, motivation, and gamification.

Firstly, the researcher discusses the importance of knowledge sharing in relation to organisations. It explains the benefits of sharing knowledge, how it can create new ideas and improve work performance and team cohesion. It also explains why some organisations fail to create a knowledge-sharing environment. One of the misconceptions is that information and knowledge is the same. To understand how to share knowledge, it is relevant to know the types of knowledge that exist. It is explained what other researchers have written regarding this matter. Tacit knowledge and explicit knowledge are the most common categories of knowledge sharing. Culture also plays a part in knowledge sharing. While people may belong to different cultures, which can affect how they work within their organisation or team, it is important for the organisation to develop a knowledge-sharing culture. This focuses on working together and developing as a team. Lastly, the researcher discusses the barriers to knowledge.

In order to share knowledge, people need to be motivated to do so. The researcher looks at how motivation works, and what is the ideal way to motivate people. The importance motivation has within organisations is discussed. Motivation is broken down into two categories: extrinsic and intrinsic. Here the researcher looks at the importance of intrinsically motivating employees to achieve personal and organisational goals. It describes why developing intrinsic motivation is more beneficial towards building a culture of knowledge sharing in the organisation as opposed to extrinsically motivating employees through rewards. The researcher looks at past motivational theories and a more recent motivational theory called the Self-Determination Theory (SDT). SDT emphases on developing intrinsic motivation, thus making it ideal for this research.

In the last section, the researcher looks at gamification. Starting by looking at what other researchers have said in regards to gamification and looking at some popular examples of gamification. The researcher discusses common gamification elements and their effects on intrinsic motivation. One of the most popular frameworks is the MDA framework, this helps understand games and provides an understanding of how gamification works. The researcher looks at Nicholson's paper on a RECIPE for meaningful gamification which ties in self-determination theory. The paper recommends what the best practices are for creating a gamification system, and how to motivate employees intrinsically. It is also important to note that all people are different. The researcher explores the different types of players by first looking at game

player types by Richard (1996) and then a more relevant view on player types paying attention to the self-determination theory and gamification. This also looks at what design elements are connected to each player type.

With this in mind, the researcher can now appropriately design and develop a system that will correctly motivate employees to share knowledge by using gamification. The following section details how this will be achieved.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The following sections provide an overview of the applied research design. Because this study focuses on developing and designing an IT-related artefact in the IS domain, it uses a Design Science (DSR) approach to conduct the study. There is sufficient literature (Gaß, Koppenhagen, Biegel, Maedche and Müller, 2012) that exists to suggest that this philosophy has been used before and is a popular choice for researchers within IS. Since Hevner et al. (2004) released their paper on Design Science Research; it has been gaining popularity. While there are arguments as to the effectiveness of DSR as a research paradigm, this study uses it. This chapter justifies this approach in the philosophical position section, followed by an introduction to DSR, how to use DSR in research, and lastly by detailing the chronological development of DSR.

In terms of data collection and analysis, the study made use of the following methods to do so:

1. Literature review
2. Interviews
3. Artefact demonstration
4. Artefact evaluation

3.2 Philosophical position

It is necessary to explain what is meant by a paradigm and how it is relevant for studies in the ICT sector to understand the philosophical position of this study.

A research paradigm is an organising structure or defined as an “accepted model or pattern” (Yvonne Feilzer, 2010). A paradigm helps direct research efforts and helps researchers with how to understand a problem and how to address it. The most commonly used paradigms in Information Systems (IS) research are namely positivism and interpretivism. More recently, researchers are using critical theory and critical realism. Each of these paradigms is characterised and composed of four parts (Dammak, 2015): Ontology, Epistemology, Methodology and Methods.

Ontology defines what reality is and how it relates to whether one believes in one verifiable socially constructed reality or in multiple. Epistemology is the study of knowledge and the acquisition of it. Together they create a holistic view of how to perceive knowledge, and how to place one’s self within it. They can be considered as the foundations for which the research is built upon (Grix, 2018). Kelly, Dowling and Millar (2018) clarify epistemology as how knowledge is created and how one learns

from it. They iterate the importance of knowing the epistemology stance as it is important in shaping the research methods. Methods are how to gather data, which will be used for interpretation. The methodology is the strategy that explains the use and choice of certain techniques (Grix, 2018). It is a summary of the research process.

With the following in mind, a research paradigm leads individuals to ask specific questions and use the correct approach to formulate inquiries. Before concluding on the philosophical position of this study, the researcher looks at existing paradigms that help understand the approach taken.

3.2.1. Positivist Paradigm

The positivism paradigm refers to the use of scientific methods to obtain new knowledge that is organised and measurable. In positivist research, new knowledge is produced deductively from knowledge that already exists by testing the constructs of empirical data (Adam, 2014). Methodologically, the suggestions or theorems made within the research are subjected to this empirical testing to make sure that it is valid. Ontologically, positivists are of the notion that facts can be proven, the reality is the same for everyone, and by observing and measuring it tells us what reality is (Ryan, 2018). This reality has to be guided by natural laws or mechanisms. Positivists consider these laws to exist by forming cause-and-effect relationships within their research (Dammak, 2015). They identify research as value-free and are purely interested in facts, which mean they hold an objectivist view. They stand apart from the participants and the subject matter, ensuring objectivity. Epistemologically, the researcher and their research object do not influence each other, and their values do not affect the outcome of the research in any way. "Positivist researchers work in a deductive manner to discover unilateral causal relationships" (Adam, 2014). These relationships can, therefore, be utilised to predict patterns across different situations.

3.2.2. Interpretivist paradigm

Interpretive research in Information Systems is useful to researchers in enabling them to see the world as a social process where the systems are regarded as a dependant of other individuals or organisations and their influences. Interpretivists assume that as people engage and interact with the world they create a meaning that is subjective based on their interactions. They assume that access to reality is only through social constructions. The ontology is that the shape of reality is dependent on the researcher's construction and therefore the ontological position is that of a subjective reality (Adam, 2014). Interpretivists are subjective who argue that both the knowledge gained and the truth discovered is subjective. Interpretive studies often reject the

possibility of any objectivity in their research. Methodologically, interpretivism focuses on collecting data through qualitative methods such as unstructured interviews and participant observations. The researchers' role is to interpret from a subjective stance and to seek explanations and understandings based off their own experiences (Kelly, Dowling and Millar, 2018).

3.2.3. Critical Theory paradigm

Critical theory (CT) looks to challenge how the world works and how we see it. At the core, critical theory aims at improving the human condition and focusing on general theoretical problems. CT acknowledges that the society has been shaped by cultural, political and ethnic factors (Rehman and Alharthi, 2016). In regards to critical theory's epistemology, it is subjective in the fact that no object of the study is researchable without the researcher affecting it. Ryan (2018) explains how critical theorists must look backwards to move forward and how the ontology for critical theory is that of historical realism. The positivist and interpretivist research paradigms focus on either its objective or subjective take on reality. Critical theory, however, spans the objective-subjective spectrum of social reality. The methodology of critical theory is dialogic and dialectical (Guba and Lincoln, 1994). This means that there is a constant dialogue between the researcher and the participants. This causes the transformation, or change, in the lives of people or organisations.

3.2.4. Critical Realism paradigm

Critical Realism (CR) distinguishes between what is the "real" world and what is the observable world. The subject of research must have actual internal mechanisms that can be made real to create certain types of outcomes. Unlike interpretivism where reality does not depend on any subjective beliefs, CR believes that the components that make up reality exist independently from human knowledge. Ontology, critical realism in IS research consists of the existence of an independent reality, which is also stratified, meaning that it is made up of structures, mechanisms, events and experiences (Adam, 2014). "The epistemological assumptions in critical realism is made up of mediated knowledge, an explanation rather than prediction, explanation by mechanisms, unobservability of mechanisms, and multiple possible mechanisms" (Adam, 2014). By going through an iterative process, CR researchers can improve their understanding of these mechanisms. Methodologically, Critical realist IS researchers involve either an objective or subjective approach. CR researchers use the "Case Study" method as the foremost approach to a research method in understanding

a phenomenon. By using a case study, they may use a mixed methodology approach, using both quantitative and qualitative methodologies.

3.2.5. Paradigm, epistemology and ontology

The paradigm defines the methodological approach taken for the study, which in turn influences the chosen research methods. This study conforms to neither of these paradigms wholly. The goal of positivism evolves around testing a hypothesis, which is not the aim of this study as it includes design-oriented objectives, albeit similar. Weber (2010) argues that neither positivism nor interpretivism truly covers design science research, which is a fundamental component of this study. Constructing an IT artefact helps address the relevance of the prototype for business requirements, and therefore aims to describe a problem solution (Hevner et al., 2004). Design science researchers believe that the “truth” is “not out there”, and therefore, like in critical theory, design science research creates an artefact that effectively changes the world (Adam, 2014). DSR can be done in an interpretive manner, which is achieved by creating theory out of the developed IT artefact and how it is used in context. The DSR approach as a paradigm combines the advantages of different paradigms (Weber, 2020). The viewpoints of both the ontology and epistemology shift in DSR as the study navigates through the different DSR activities.

By definition of DSR, introducing an artefact changes the "state of the world" which therefore allows DS researchers to be comfortable with alternative world-states. This is a clear contradiction with the positivist ontology where only a single (socio technical) system is the normal unit of analysis. The multiple world-states of DSR, however, are not the same as the multiple realities of interpretivism. DS researchers believe in one single reality that "constrains multiplicity of world-states" (Kuechler, Petter and Vaishnavi, 2012). Epistemologically, the DS researcher is aware that any given piece of information is factual. They know even more what that piece of information means through the development process.

Design Science Research as a paradigm is new and has yet to reach its full potential (Gregor and Hevner, 2013). Gregor and Hevner (2017) describe in detail how a difference of opinion has emerged within the design-science paradigm community, for example, the split into a design-theory side, and a pragmatic-design side. DSR is more of a “problem-solving paradigm”, with the objective of creating innovations through analysis, design, implementation and management of IS. Regardless, the main purpose of using DSR as a research direction ensures there is both rigour and relevance in the prototyping research (Hevner, 2007; Weber, 2010) and for this study, the researcher acknowledges design science research as a paradigm.

3.2.6. Axiology

Axiology is a branch of philosophy that looks at how different people define the value of something. From philosophy axiology, one may obtain two types of values: aesthetics and ethics (Saunders, Lewis and Thornhill, 2009). This study does not adopt the axiology philosophy completely, as it does not deal with the nature of values. However, because it places great importance in data collected through interviews along with their opinions, it is important to note the ethics. This study involves participants from one organisation. The answers the participants contribute, and subsequent discussions that follow were of their views, opinions and preferences.

All participants involved in this study were informed in advance about the purpose of the study and what their role was. They may be required to give their consent if the organisation so chooses to. Their identity remains confidential and in terms of the organisation, their privacy policies will be adhered to. The researcher may be required to sign a consent form by the organisation to adhere to their confidentiality and privacy policies and to ensure none of their sensitive information is documented. Consent from the organisation to interview employees was required and formed part of the ethics approval letter (see Appendix A). This study adheres to the ethical standards of the University regulations. It seeks to gain new knowledge and contribute to the body of knowledge without ambition for commercial profit. Through innovation, the researcher gained new knowledge and artefactual impacts and extended knowledge boundaries.

3.3 Introduction to Design Science

Design science research is a “lens” for carrying out research in Information Systems. Design science includes creating new knowledge through designing an artefact, and it includes the analysis of the artefact’s use and performance. These artefacts include, but are not limited to, algorithms, computer interfaces, system design methodologies, languages etc. Design Science researchers are more inclined to be found in Engineering and Computer Science, but it is not unlikely to find them within other fields of research.

The process of designing and developing artefacts is an activity that has been around for centuries (Kuechler, Petter and Vaishnavi, 2012). Simon (1996) discussed how the natural sciences almost drove out the “design” from professional academic curriculums, excluding computer science and chemical engineering fields. Natural science has become one common paradigm of choice for research; however, this alone does not address the needed design science (excluding perhaps action research). Unlike Action Research (AR), Design Science Research (DSR) is not for any specific client or for any researcher/client association. While the developed artefact

within DSR aims at addressing a class of issues, it may do so in such a way that is useful in addressing specific client problems. This study involved one organisation; however, it is for an identified problem that may arise from other organisations within the ICT sector.

To ensure that IT research is of relevancy and effectiveness, it is important to include both natural science and design science activities (March and Smith, 1995). Natural science focuses on trying to understand the "reality" and is concerned with explaining how and why things are. Design science tries to create things that have a benefit to humans; often the result is technology-orientated. Design science aims to achieve its goals by developing artefacts, using design as the core function. Design means to "invent and bring into being". For this reason, researchers in fields like architecture, engineering or urban planning, where the fields are not deemed as pure "science", often include design as a key activity. Another important difference is that natural sciences focus on developing theories, whereas design scientists aim to create patterns, models, methods or implementations that are innovative and have value going forward (March and Smith, 1995).

At the core, design science consists of two activities, build and evaluate. Artefacts are measurable (evaluated) by their value, which means it works and serves a purpose. Artefacts may fail because they do not fit within their environment. This is why it is important to understand the environment foremost, as an incomplete understanding of it can lead to inappropriately designed artefacts or unwanted side effects. It leads us to acknowledge a framework for IT research that includes both natural science (theory) and design science (utility).

Gregor and Hevner (2013) compiled a knowledge contribution framework from research project contexts and potential DSR contributions, which helps to understand the output of DSR. In Figure 6, the x-axis of the matrix shows the maturity of the problem and the y-axis shows the existing maturity level of the artefact for potential starting points for solutions (what is currently known). In their framework (Figure 6) exaptation, invention, and improvement are types of knowledge contributions in DSR. Routine design on its own, however, may not be considered as a research contribution (Kuechler, Petter and Vaishnavi, 2012), but it may serve as an interesting topic to be researched nonetheless.

- Exaptation: using inconsequential known knowledge or solutions for new problems
- Routine design: applying knowledge that is known to problems that are known
- Invention: inventing new knowledge or solutions for problems that are new

- Improvement: creating new knowledge or solutions for problems that are known

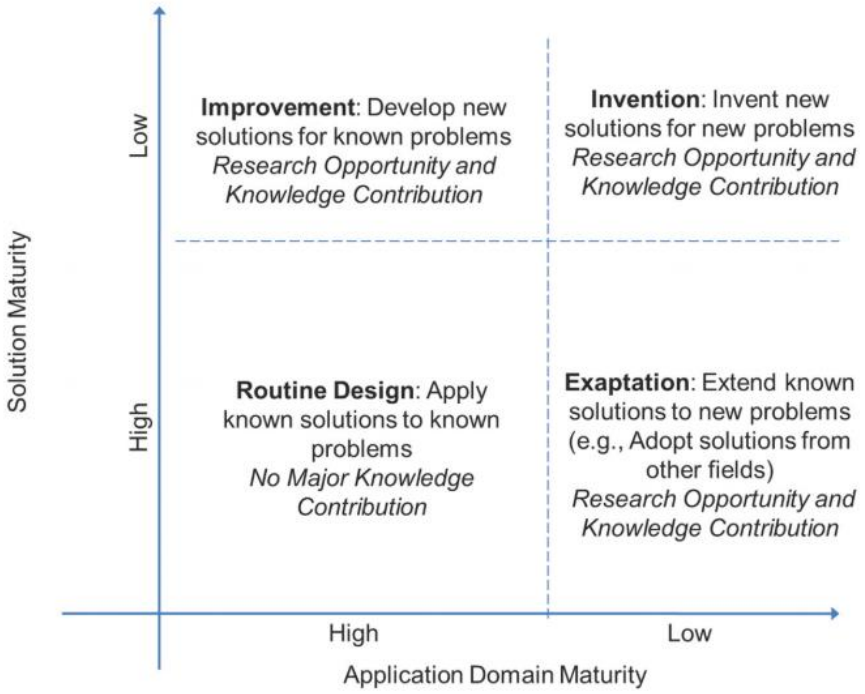


Figure 6: DSR Knowledge Contribution Framework (Gregor and Hevner, 2013)

While this is one definition of DSR outputs, there are many other output classifications defined by other researchers, as Kuechler, Petter and Vaishnavi (2012) discuss in their paper. The basic aim of DSR is to contribute or create new DS knowledge in an area of interest with the form of this knowledge being a design theory (albeit unlikely from one single research paper but rather a community), or an artefact of some sort (construct, model, method and/or instantiations).

3.4 Using design science in research

The core principle of DSR is that by building and applying the artefact in context, knowledge around the solution and understanding of the design problem is attained (Hevner, March, Park and Ram, 2004). The artefact creates a new reality for those who will potentially use it. The result of DSR is a meaningful IS artefact with the purpose of addressing a significant problem within the organisation (Hevner et al., 2004). Livari and Venable (2009) identified “solution technology invention” as the central aspect of DSR. It is a lens for performing research in IS, which involves two primary activities:

1. The creation of new knowledge through the design of new artefacts
2. The analysis of the artefacts use and/or performance

Hevner et al. (2004) defined how to conduct, evaluate, and present design science research by describing the boundaries of design science and by developing a set of

guidelines. This study will follow these seven guidelines that have been adapted by Peffers et al. (2008), as seen in Figure 7. The seven guidelines are set out in the table below.

Table 3: Guidelines to DSR (Hevner et al., 2004)

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

To summarise these guidelines, the following is an accurate description by Hevnar et al. (2004) of how the guidelines fit together.

> "DSR requires the creation of an innovative, purposeful artefact (guideline 1) for a specified problem domain (guideline 2). Because the artefact is purposeful, it must yield utility for the specified problem. Hence, a thorough evaluation of the artefact is crucial (Guideline 3). Novelty is similarly crucial since the artefact must be innovative, solving a heretofore unsolved problem or solving a known problem in a more effective or efficient manner (Guideline 4). The artefact itself must be rigorously defined and internally consistent (Guideline 5). The process, by which it is created, incorporates or enables a search process whereby a problem space is constructed and a mechanism posed or enacted to find an effective solution (Guideline 6). Finally, the results of the design-science research must be communicated effectively (Guideline 7) both to a technical audience and to a managerial audience" (Hevner et al., 2004).

The third guideline, design evaluation, is the crucial step of the research process. This can include the integration of the artefact into the technical infrastructure of the organisational environment. Because design is naturally an iterative process, the

design evaluation phase (third guideline in the above table) provides the necessary feedback for the construction phase of the artefact (Hevner et al., 2004). The evaluation of the artefact provides important feedback to improve the artefact and ensure its success within the context organisation.

In order to present the development of this study, it used a design cycle created by Peffers, Tuunanen, Rothenberger and Chatterjee (2008) (see Figure 7), which is still widely used and relevant to this day that follows the seven guidelines in Table 3. There have been several different models or variations that have developed from Hevner et al's (2004) original model that helps communicate engineering design processes in a simplistic and understandable way. It incorporates the guidelines defined above.

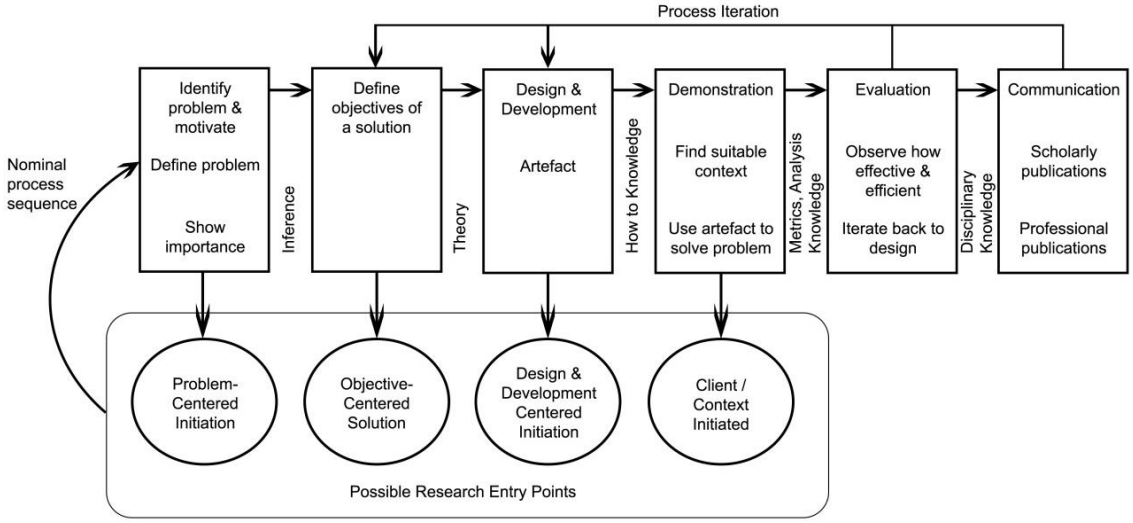


Figure 7: Design cycle process (Peffers et al., 2008)

3.5 Overall research design

In the previous section, the researcher introduced Design Science Research and described the general approach that is required for this study. The following section defines how this study met the expectation of Design Science by going through the activities as depicted in Figure 7, and how they are connected to the overall Design Science research process. Here the researcher designed a gamified system aimed at motivating employees to share knowledge using knowledge gained from the literature and the organisation's current environment setting, as well as how to evaluate the artefact's effectiveness.

3.5.1. Activity 1: Identify the problem

The first activity of the selected DSR process is to identify and motivate the problem within the context organisation. In order to accomplish this, a questionnaire was drawn

up using elements from previous research. This assisted in establishing whether employees within the organisation are motivated to share knowledge, and how they feel about the existing knowledge sharing activity in place within their organisation.

By utilizing an existing questionnaire, or using sections of an existing questionnaire, it reduces the need for piloting, and secondly, helps the researcher in knowing that the questions have been subject to testing for validity and reliability (Bell, Bryman and Harly, 2018). While using existing questionnaire, or parts thereof, may reduce the need for piloting, the researcher ensured the validity of the questionnaire by testing and (retesting it) against members of the organisations' Human Resources department, which provided a level of face validity.

In Fullwood & Rowley's paper (2017) they investigate factors affecting knowledge sharing amongst employed U.K academics. They used a questionnaire-based survey to establish attitudes and intentions towards knowledge sharing. One of their conclusions was that the link between technology and knowledge sharing is weak, stating that organisations should be asking themselves whether their existing knowledge sharing system is working.

A paper by Bock, Zmud, Kim and Lee's (2005) called *Behavioral Intention Formation in Knowledge Sharing* is also leaned upon for this initial questionnaire. The questionnaire they developed and used to gather information looks at measuring various constructs, which most importantly include attitude toward knowledge sharing and their intention to share knowledge.

Other papers that helped establish this questionnaire include Chumg, et al's. (2016) paper titled *Factors Affecting Knowledge Sharing in the Virtual Organisation*. Here they measured how effective employees were at sharing tacit and explicit knowledge.

Lastly, In Lin's (Lin, 2007b) paper, it included examining the technological and organisational factors on knowledge sharing for these processes. The findings of this study were that employees' willingness to share knowledge enabled the organisation to improve their innovation capability.

By considering these papers as a guideline, a set of questions (statements) were drawn up to help identify whether the problem exists within the context organisation. Four sections for the questionnaire were identified. They are:

1. Whether employees are willing to accept knowledge and consult other employees for their intellectual capital. This term is defined as *"knowledge collecting"* and stems from the basic definition of knowledge sharing (see 2.2 Knowledge sharing)

2. Whether employees are willing to share their knowledge and communicate the knowledge to others. This term is defined as *"knowledge donating"* and also stems from the basic definition of knowledge sharing (see 2.2 Knowledge sharing)
3. Whether employees feel that there is sufficient information technology available within the organisation. This section is defined as *"ICT use"*, which covers the technology and systems as discussed in the literature (see 2.2 Knowledge sharing).
4. How employees perceive their managers' role in the knowledge sharing process. This section is defined as *"Management support"*, and is an integral part of the research problem.

By asking questions within these sections, the researcher can identify if the problem exists within the context organisation.

The questionnaire made use of a four-point ordinal (1-4) Likert-scale: strongly agree, agree, disagree, and strongly disagree. By using a four-point scale, it disallowed the participant from selecting a neutral option. After each section, there was space for the participant to give any additional comments or feedback should they have any.

Statements for the participants to measure include, for example:

- I approach colleagues in other teams to gain knowledge
- I willingly share any new ideas or skills I may have with my colleagues
- I willingly share knowledge with employees in other teams
- My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
- Management encourages and motivates knowledge sharing

See Appendix B for the complete questionnaire form used.

3.5.2. Activity 2: Define the objectives of the solution

After identifying the problem within the organisation, the next activity is to specify objectives and/or goals of a solution based on the identified problem. The objectives of the solution need to be possible and feasible. These objectives can be either qualitative or quantitative. Qualitative objectives could include descriptions of how a new artefact could support the solution to the problem, while quantitative objectives may be the terms in which an ideal solution would be better than existing ones.

The objectives for this study stem from the research problem discussed in Chapter 1 along with the outcome of Activity 1 of the Design Science Research process described in the previous section.

3.5.3. Activity 3: Design and develop an artefact

The core activity of the DSR process is the designing and development of an artefact (Peffers et al., 2008). In this activity, the artefact is developed. While the artefact can be constructs, models, methods or instantiations, this study created a prototype of a knowledge-sharing system. It was important to ensure that there was a research contribution embedded in the design.

The artefact was designed using software called *UXPin*. *UXPin* is a product design platform that allows for the design, collaboration and presentation of wireframes, mock-ups and prototypes. It is ideal for prototyping web or desktop-based applications that require lightweight interactions. UXPin allows for interactive “stateful” elements helping reduce the time needed to repeat duplicate elements. It also includes conditional interactions, variables and expressions, which help to give the artefact the sense of realism when the employee evaluates the artefact at meeting the required objective.

To assist in the design process, multiple mind maps were drawn. As ideas from the literature and from interviews came, they were placed on a mind map. The last mind map drawn is shown in Appendix C.

3.5.4. Activity 4: Demonstration

The next activity upon completion of the artefact is to demonstrate it to employees. In DSR, “demonstration” could involve experimentation, simulation, proof or another appropriate activity of demonstration (Peffers et al., 2008). To demonstrate the prototype it requires effective knowledge on how to the artefact works and how it may solve the problem. For this study, the participants received an explanation of each feature of the prototype. Their response and feedback were then used in another iteration of a design/build phase before the final evaluation process.

3.5.5. Activity 5: Evaluation

The aim of the evaluation activity is to establish whether the designed artefact from Activity 3 meets the goal and objectives. A gamification application can be evaluated from a range of quantitative to qualitative approaches (Morschheuser et al., 2018). Morschheuser et al. (2018) discuss the different ways to evaluate a gamified artefact, stating that apart from interviews with participants, the most common way is by means

of playtesting. Playtesting refers to observing a participant, monitoring their behaviour all while they try and use (play) the system.

To evaluate the effectiveness of the artefact at reaching the goal, this study used a Goal Question Metric approach. The Goal Question Metric (GQM) approach helps to choose the appropriate metric to measure the effectiveness of the product or artefact. It is a technique used to identify metrics for the measurement process. Overall, GQM is the specification of a measurement system that looks at a specific set of issues or features and includes rules on how to interpret the measurement data (Basili, Caldiera and Rombach, 1994). The measurement model has three levels:

1. Conceptual level (GOAL)
2. Operational level (QUESTION)
3. Quantitative level (METRIC)

GOAL

“A goal is defined for an object for various reasons, with respect to various models of quality, from various points of view and relative to a particular environment” (Kassou and Kjiri, 2012). While the object of measurement can be a product, process or resource, here the object of measurement will be the artefact (product).

QUESTION

“A set of questions is used to characterize the way the assessment/achievement of a specific goal is going to be performed based on some characterizing model.”

METRIC

“A set of metrics is associated with every question in order to answer it in a measurable way”. Metrics can be objective or subjective. Objective metrics are metrics that only depend on the object being measured and not on the viewpoint from which it is taken. Subjective metrics are metrics that depend on both the object that is being measured and the viewpoint from which they are taken (Basili, Caldiera and Rombach, 1994).

GQM is a hierarchal structure that starts with the goals, which are then refined into various questions and then refined further into metrics. This is depicted in Figure 8.

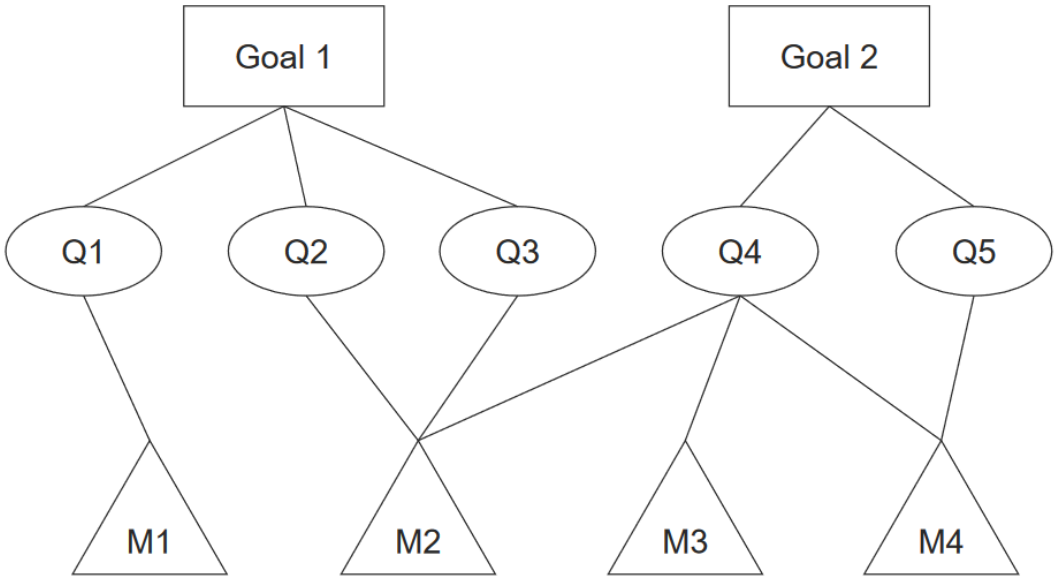


Figure 8: How Goals, Questions & Metrics relate

The goals and questions derived from this study and its previous chapters, while the metrics came from a set of weighted questions. This helped attain an understanding of whether the prototype was a viable solution. It consisted of ten in-depth interviews with employees who viewed and reviewed the prototype.

3.5.6. Activity 6: Communication

Peffers et al. (2008) cited the necessity of "communicating the problem and its importance, the artefact, its use, the rigour of the design, and its effectiveness to both researchers and other relevant audiences", such as those in management of the context organisation. This may be achieved by writing and documenting the results within this study and publishing it to established journals. For this study, management was informed by means of a written report that summarised this study. The report contained information such as:

- The identified problem from the interviews
- Solution with goals derived
- Prototype overview and its functionality
- Employees feedback on the prototype

Management can then formulate strategies and plans for their organisation going forward.

3.6 Chapter summary

This chapter provided a detailed explanation of the scientific approach to achieving the research problem, the respective goals and answering the questions. Firstly, the worldview of the researcher is discussed, in terms of the ontological and epistemological position. Ontologically, multiple alternative world states exist. They are contextually situated. Epistemologically, knowledge is made through the process of making the artefact, utilizing an iterative process.

The researcher adopts a method called Design Science Research that consists of six activities. They are identifying the problem, defining objectives of a solution, designing and developing an artefact, demonstrating artefact, evaluating and communicating. The Design Science approach consisted of interviews, where a sample population of twenty random participants from one IT-related organisation was chosen. This data was collected from the participants using a Likert Scale questionnaire and serve as (quantitative) data collection. The artefact was evaluated using the Goal Question Metric method.

This chapter also details the ethical processes engaged by the researcher to safeguard the confidentiality and anonymity of the participants.

The following chapter provides the results of the first five activities of the Design Science Research cycle. These include answers from participants in identifying the problem within their organisation, the features of the prototype and the results of the Goal Question Metric software evaluation technique.

CHAPTER FOUR: RESULTS

4.1 Introduction

The following chapter details the outcome from each activity of the Design Science Research cycle, where gamification was used as a motivation tool to positively affect employee motivation. The activities of the Design Science Research process are as follows:

1. Identify the problem: how the research problem was identified within the context organisation and the relevant results
2. Define objectives: how the objectives for a solution were derived and what they are
3. Design and development of artefact: an in-depth overview of the features of the prototype artefact
4. Demonstration: demonstration of the artefact to employees and their suggestions for improvement
5. Artefact evaluation: the results from evaluating the effectiveness of the artefact at achieving the goal

By completing these activities, the researcher creates new knowledge for a known issue (known as “improvement” knowledge contribution, see Figure 6 and corresponding description for more information).

4.2 Results from the Design Science Research method

The following sections describe the results and outcomes of the design-science research process.

4.2.1. Activity 1: Identify the problem

Below are the results of the constructed questionnaire in the Research Methodology chapter. The questionnaire aimed to identify the problem described in the research problem statement in Chapter 1 and motivate for a solution within the organisation. See Appendix D for the complete responses to the questionnaire from the 20 participants. The results are shown below.

The questionnaire was divided into four sections: Willingness to accept knowledge and consult others, willingness to share knowledge and communicate knowledge to others, sufficient Information Technology within the organisation, and manager’s role in the knowledge sharing process.

4.2.1.1. Willingness to accept knowledge and consult others

In the questionnaire, the first section aimed to measure whether employees are willing to accept knowledge and consult other employees for their knowledge. This section consists of five Likert items (statements), which the participants rated.

Likert item 1 (in Figure 9) shows that all participants agreed to participate in knowledge sharing with their colleagues (from 35% agreed and 65% strongly agree). They also agreed to share their knowledge whenever they were asked to (Likert item 4).

In terms of employees teaching each other valuable techniques they know to one another (Likert item 2), 85% of participants stated they engage in this activity, while 15% stated they do not.

The majority of participants, however, disagreed in approaching or consulting colleagues in other teams to gain knowledge (Likert item 3). Some participants stated that there is no means of knowing what knowledge existed in other teams and therefore were unsure whether it might benefit them or not. Of the three separate teams from which the participants are from, on average, only one of the three teams actively sought out other teams to seek knowledge.

All participants agreed that a system to help acquire work-related knowledge from others would be beneficial (Likert item 5).

In summary, employees are willing to accept knowledge but fail to consult other teams in knowledge sharing for various reasons. A system to assist them would be beneficial and would be used by employees to help them acquire knowledge and to seek knowledge from other teams.

The results from this section are shown in Figure 9's diverging stacked bar chart, where the "disagrees" are on the left (red/orange), and the "agrees" are on the right (light green/green).

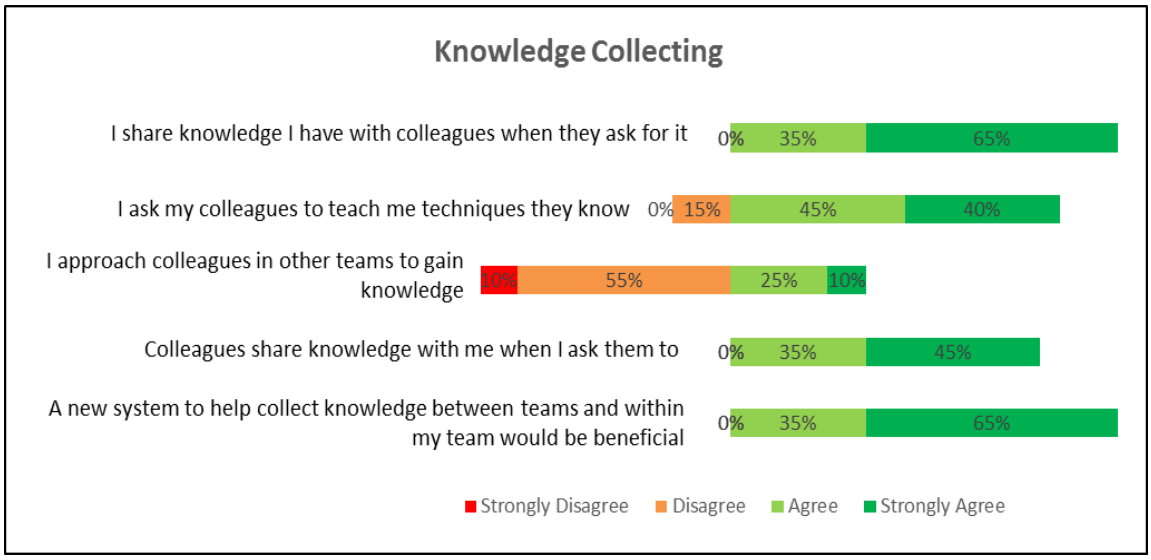


Figure 9: Results of knowledge collecting within the organisation

4.2.1.2. Willingness to share knowledge and communicate knowledge to others

The second section aimed to measure whether employees are willing to share their knowledge and communicate knowledge to others. This section contains five Likert Items for the participants to rate.

Just over half of the participants (55%) stated that their colleagues did not always inform them about what they had learned on the job, for reasons such as not having a platform do so (Likert item 1).

However, participants are willing to share their new ideas and skills with their colleagues (Likert item 2).

One participant explained that not everyone wants to know when they have learned something new. Others stated they would like to know what others have or are currently learning to better connect and relate with their colleagues. One participant noted that they keep their new skills to themselves, while another participant claimed that there is insufficient time or not an appropriate time to share newfound skills.

While participants overall stated they enjoyed sharing knowledge (Likert item 4), only half of the participants stated they would willingly share knowledge with employees in other teams (Likert item 3). Some felt they would not be able to give sufficient help (because they are a new member of the team) and would only waste time.

All participants agreed that a system to place their knowledge in and communicate their knowledge would be beneficial (Likert item 5).

In summary, employees are willing to share their knowledge and communicate the knowledge to others in their team, but there is room for improvement in sharing

knowledge between teams. A system on which employees can share their successes and newfound skills was deemed beneficial.

The results from this section are shown in Figure 10's diverging stacked bar chart, where the "disagrees" are on the left (red/orange), and the "agrees" are on the right (light green/green).

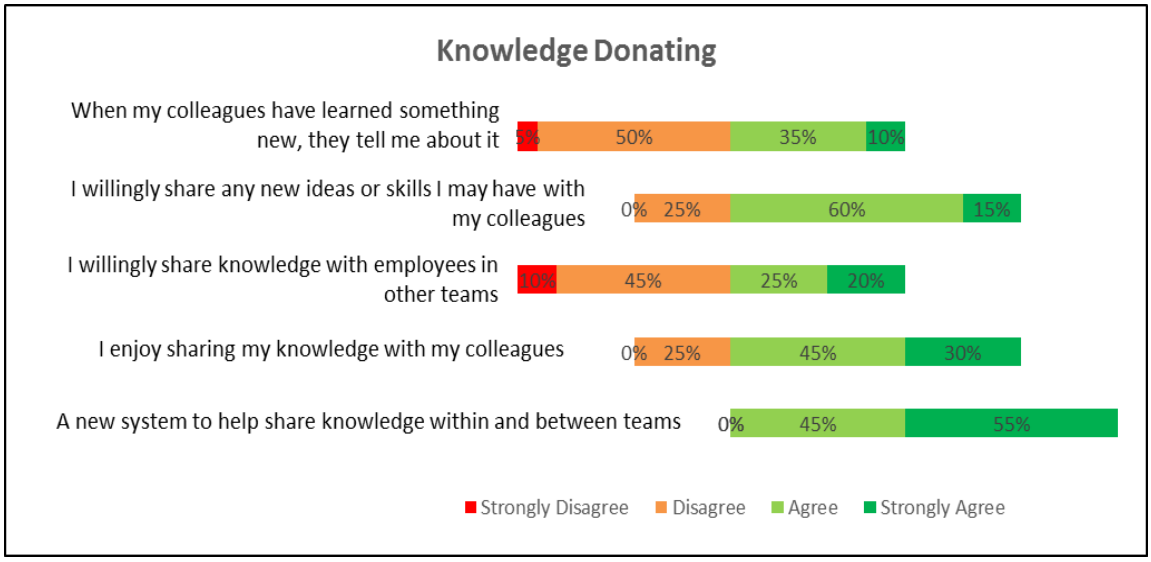


Figure 10: Results of knowledge donating within the organisation

4.2.1.3. Sufficient Information Technology within the organisation

The third section aimed to measure whether employees felt that there is sufficient existing information technology available within the organisation. This section contains five Likert items.

More than half of the participants (65%) stated that their organisation does not make use of technology to share knowledge between employees (Likert item 1). Some participants could not clearly define what technology they use as it is infrequently used. Participants from one of the three teams all disagreed that there is any technology readily available to assist in knowledge sharing.

There was also a consensus that there is no storing technology in place (Likert item 2), with the majority stating that there is no place for them to obtain or view the collective organisational knowledge.

Only 40% of the participants stated they make use of knowledge networks to communicate with other colleagues (Likert item 3). Participants mentioned that it is not consistent.

The majority of the participants did not feel that the organisation, or their team, allocated sufficient resources to sharing knowledge (Likert item 4). Often, time was the

main factor. Only one of the three teams stated that they are given an allocated amount of time for sharing knowledge, however not always enough due to the complexity of sharing knowledge or a large amount of work that may be due for that month.

The majority of the participants stated that they are unable to share knowledge from colleagues in other teams (Likert item 5). One participant stated that sharing knowledge is very selective and mostly based on the resources required to complete a specific task, often assigned by a manager. This manager is then the only person who knows that another team may be of assistance.

In summary, the organisation has insufficient technology for sharing knowledge between teams and for allowing employees to communicate with others. There is no one distinct system throughout the organisation in place for an employee to use for knowledge management.

The results from this section are shown in Figure 11's diverging stacked bar chart, where the "disagrees" are on the left (red/orange), and the "agrees" are on the right (light green/green).

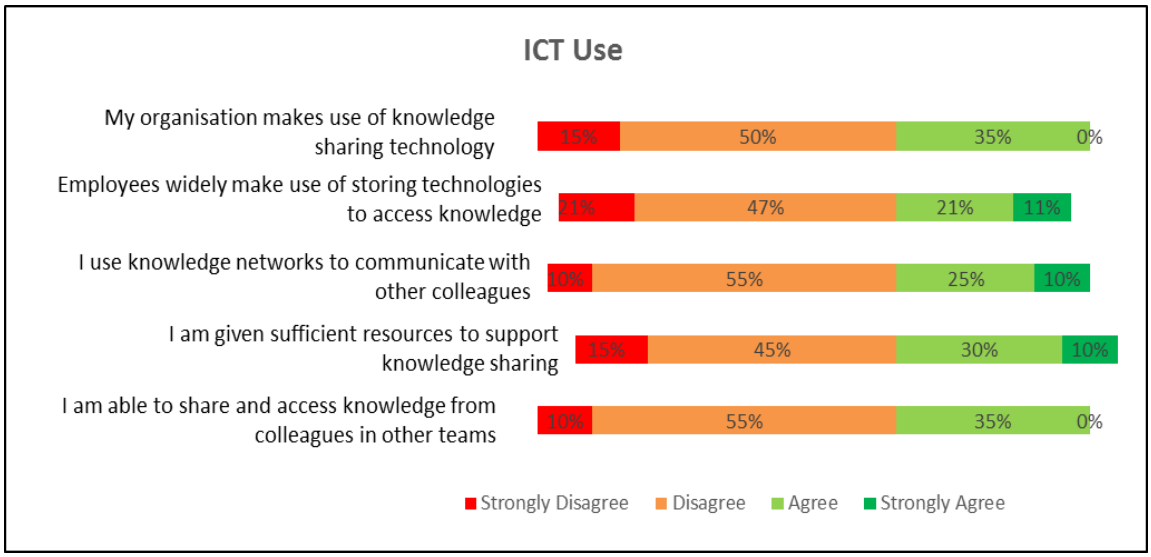


Figure 11: Results of ICT use within the organisation

4.2.1.4. Managers role in the knowledge sharing process

The last section measured how employees feel about managements' role in the knowledge sharing process. This section contains five Likert items, of which the participants view and rate.

Eighty-five per cent of participants feel that managers believe in the importance of knowledge sharing (Likert item 2). However, 55% of participants stated that

management does not engage and create enough opportunities for knowledge sharing within the organisation (Likert item 4).

The results show that 60% of participants felt that management could provide more encouragement and motivation for knowledge sharing between teams (Likert item 1) and 50% stated that management could provide more encouragement for knowledge sharing between colleagues within the same team (Likert item 3).

Participants agreed that a system where managers can monitor knowledge sharing with the organisation would be beneficial (Likert item 5). However, one participant stated that if there are (knowledge sharing) problems found using the application, it should be brought to the management by means of verbal communication and not through the application alone.

In summary, employees do feel that managers value knowledge sharing, but do not provide sufficient resources or encourage knowledge sharing to enable it between teams.

The results from this section are shown in Figure 12's diverging stacked bar chart, where the "disagrees" are on the left (red/orange), and the "agrees" are on the right (light green/green).

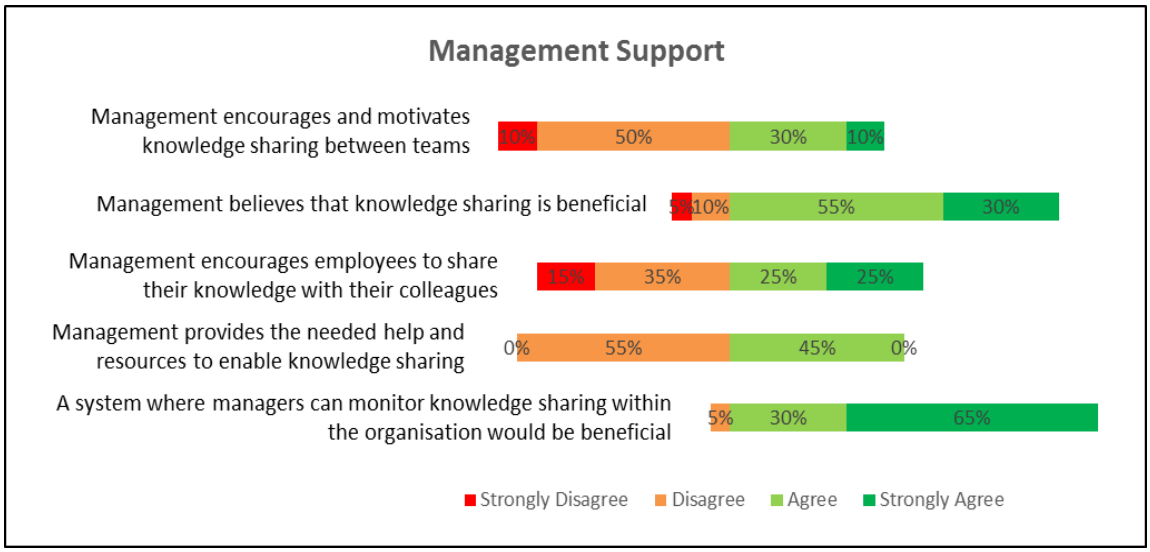


Figure 12: Results of management support within the organisation

From the questionnaire results, the researcher identified both the problem and how to improve the current knowledge sharing process. The results state that while employees do share their knowledge, they are not sharing across teams. There is not enough motivation to share knowledge between teams and within their team. ICT is insufficient and does not help employees to store their knowledge or share it across the organisation.

From the questionnaire, the researcher made the following assumptions, which follow on to the next activity:

- There is a clear need for an organisation knowledge sharing system.
- Management believes that knowledge sharing is beneficial and will support the idea of a new system.
- Employees are willing to share knowledge, and therefore will be willing to use the system to share knowledge.

4.2.2. Activity 2: Define the objectives of the solution

A solution to the problem was to create a prototype that would represent a knowledge-sharing system where employees can interact with others in the organisation. The artefact needed to allow for knowledge sharing and to motivate the employee to share their knowledge.

The goal of the artefact was to improve employee motivation to share knowledge within their team and other teams. This stems from the goal defined in Chapter 1 and applies here.

The following is the organisations (business) requirements for the system. It should be easy to use so that the employees adopt it quickly. It must allow for customisation. This will allow employees to access information on-demand, showing them what they want to see first, foremost. The system must include options for collaborating online or in person. It will allow opportunities to create work-related presentations or creating ideas within the organisation. The system should include opportunities for recognising the top contributors or influencers within the system. It provides merit and adds an element of gamification.

In summary, the study identified the following objectives for this specific prototype artefact by means of the business requirements, the literature review and the results from activity 1. They were:

1. To provide one single platform that all employees may use.
2. To enable employees within a team and across teams to communicate with each other.
3. To develop a document management section where teams may store their relevant team documents and/or information, allowing all employees to view it.
4. To provide a section for employees to collaborate and help each other on issues or topics of interest.
5. To add gamification to core elements of the system, helping to motivate employees to share knowledge.

6. To create a section where employers can upload or create courses, and for employees to find and learn courses relating to their career.

4.2.3. Activity 3: Design and develop an artefact

This section documents the design of the artefact and its core features. For the sake of completeness, both iterations of the design process are detailed. Activity 4 (demonstration) provides a more detailed breakdown of the outcomes of the two rounds of the design-feedback loop:

The gamified knowledge-sharing prototype is divided into three core sections, namely the Q&A forum, WIKI site, and the Learning Academy.

Within these three sections, gamification is applied. The objective of gamification is to improve motivation to use the system and thus affect the sharing of knowledge within teams and across teams.

Additional sections of the system include:

1. Dashboard
2. Chat forum
3. Game/statistics section
4. News
5. I.T Support
6. One Drive

All names, team names and data are random and do not represent actual employees or teams within the organisation. Below is a detailed breakdown of each section and its functionality.

4.2.3.1. Q&A Forum

The Q&A forum allows for employees to ask questions in a safe, constructive place, and for other employees to answer these questions in as much detail as they wish. The objective of this is to allow employees to ask questions that other teams may find relevant. In doing so, this provides a platform for storing knowledge that can be viewed by new employees or consulting at a later stage. This is unlike emails, where it may become lost, or only directed to one person.

Berends (2005) identified a "taxonomy of 29 moves" by which knowledge is shared. He grouped these 29 moves into five categories. They include Descriptions, Actions, Questions, Proposals/Suggestions and Evaluations. The Q&A section of the prototype acknowledges these five categories, allowing for knowledge sharing through employees asking questions, and employees answering (or evaluating) questions.

A Q&A dashboard is the first page they see when opening the Q&A forum. Shown here are all questions created, with a filter option for the employee to use to narrow down the list of questions.

Filter options include:

- Filtering by team
- Filtering by status such as open/closed
- Filtering by a specific employee
- A unique text that may exist within the question

Additionally, the employee has the option of filtering questions by certain tags as shown on the right in Figure 13. Tags are keywords that help describe and categorise the question into sections. Tags are especially useful in categorising work: if a team is starting a new project using a different/new tool, they can see if any other teams have had questions relating to it.

Lastly, shown alongside their gamification character is a breakdown of the employees' points and statistics. This allows the employee to see, visually, which areas they have contributed more towards and the total gamification points they have earned from doing so.

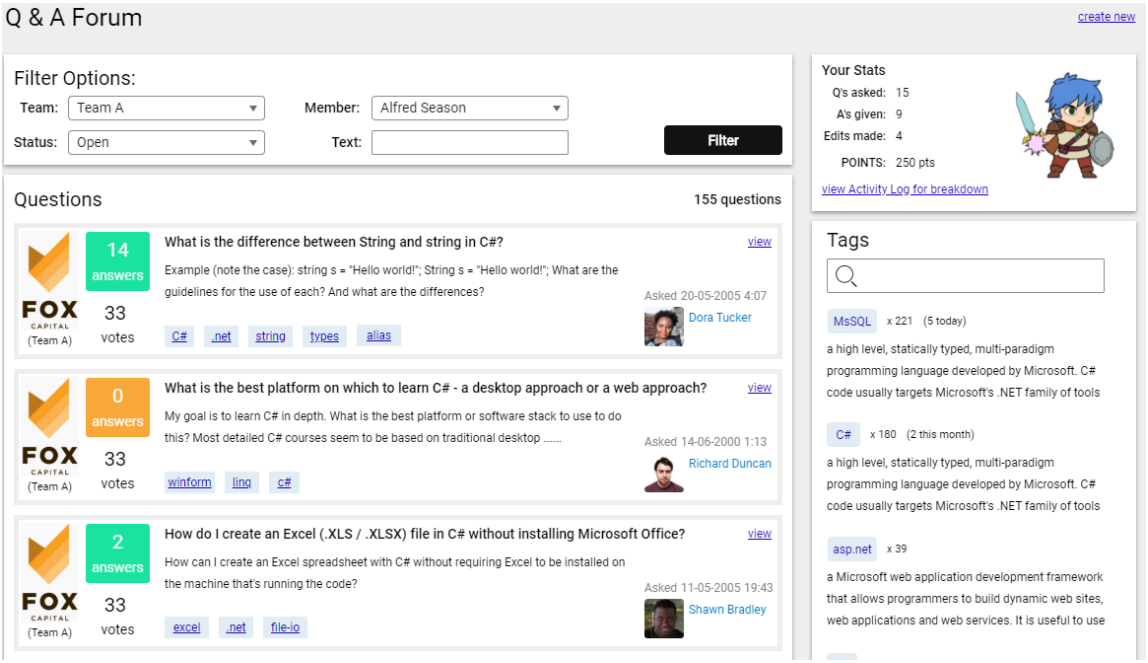


Figure 13: Prototype design – Q&A Forum overview

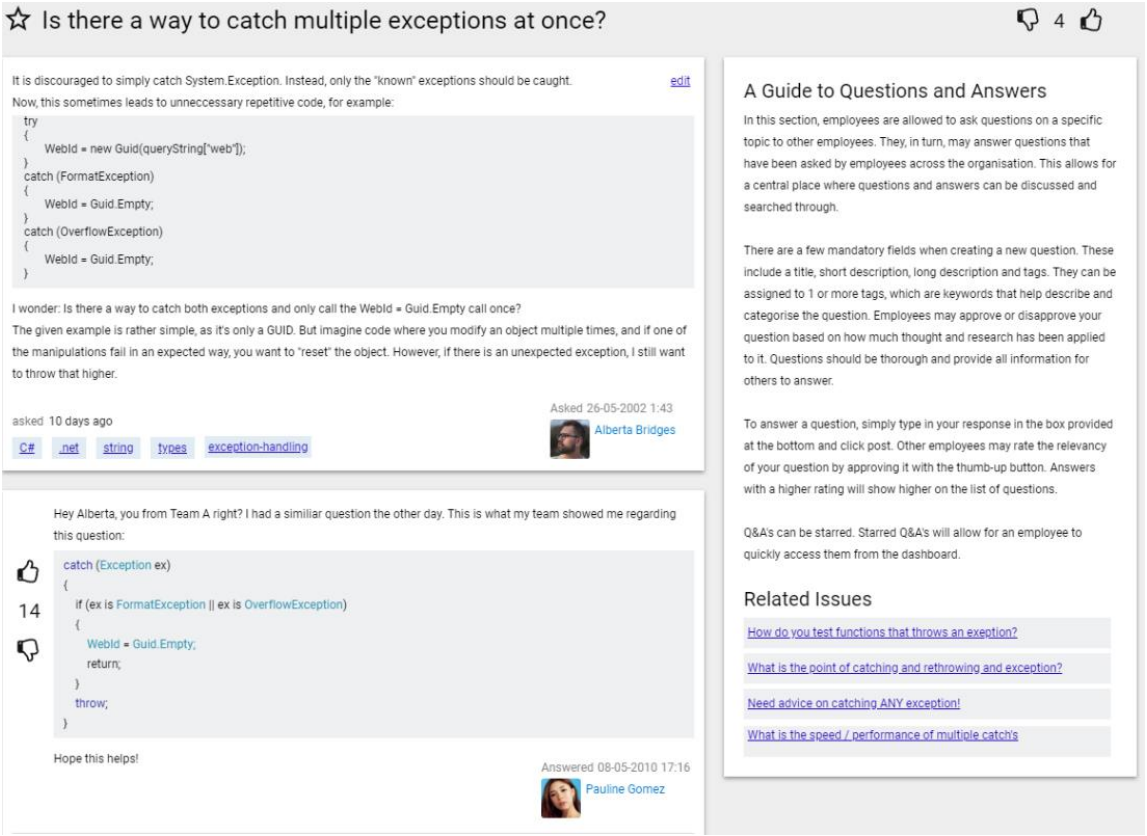


Figure 14: Prototype design – Q&A page

Figure 14 shows an example of a Q&A page selected from the Q&A dashboard. Within this page, there are four sections to note:

1. Question title preceded by a star button and followed by a thumb up and thumb down button
2. The question block
3. Answer block with all answers
4. Your answer
5. Related issues

4.2.3.1.1 Question Title

The question title at the top of the page has a star button that allows a person to “favourite” the question. If they find this question to be of importance and relevance to them or something that they will consult frequently, they can “star” it. This will place the question in a list that is more easily accessible on the dashboard for them to utilise. Shown in Figure 15 is an example of this star feature.

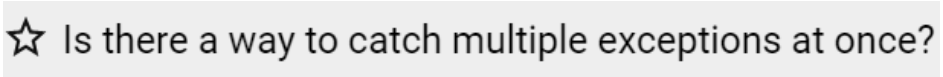


Figure 15: Prototype design – Q&A star button

After the question title, there is an option to thumb up or thumb down the question. This functionality allows for employees with a higher level (gamification level based on their activity and contribution, discussed later) to approve whether the question has been asked constructively with sufficient information given and that the employee who asked it has consulted other sources and not found a correct answer. This functionality serves to remove ambiguous questions. Higher-level employees may close/reopen questions.

Figure 16: Prototype design – Q&A like & dislike button

4.2.3.1.2 Question Block

The question block contains the question along with any attachments. This area allows for special text, which a person may edit at a later stage. When creating a question, it is assigned tags, which categorises the question. Within the “question” block are the details of the employee who created it.

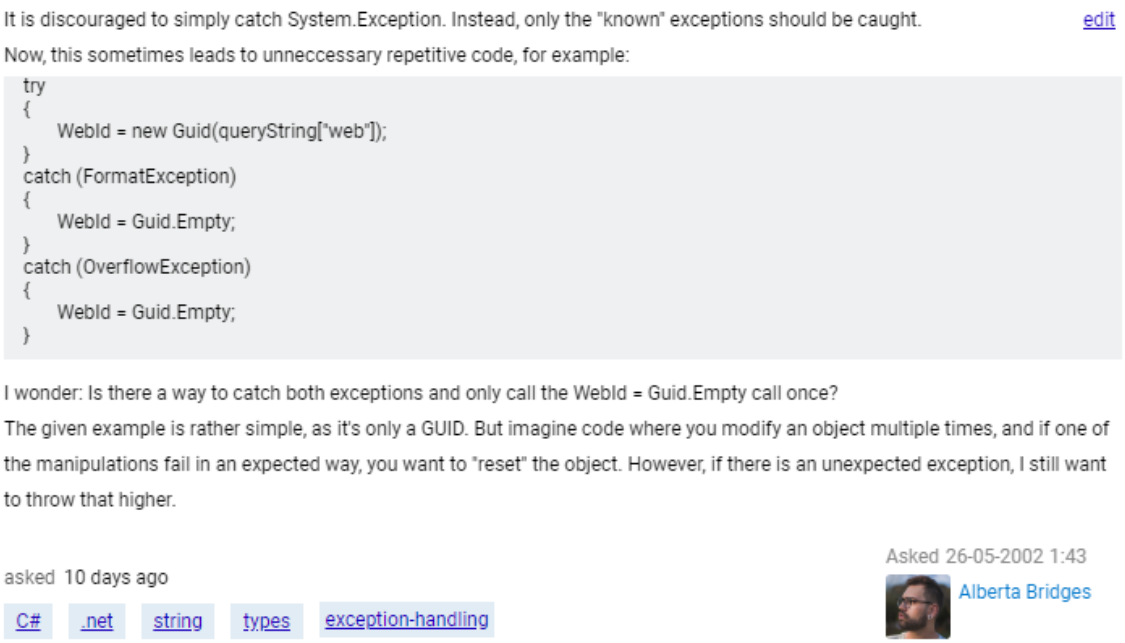


Figure 17: Prototype design – Q&A question block

4.2.3.1.3 Answers Block

The answers section is similar to the question block. It shows all of the answers to that specific question. The notable difference is that all employees may vote on a question by either clicking on the "thumb up" or "thumb down" button that is adjacent to the question. Answers with a higher number are shown higher up the list of answers. In Figure 18 there are two answers to the question.

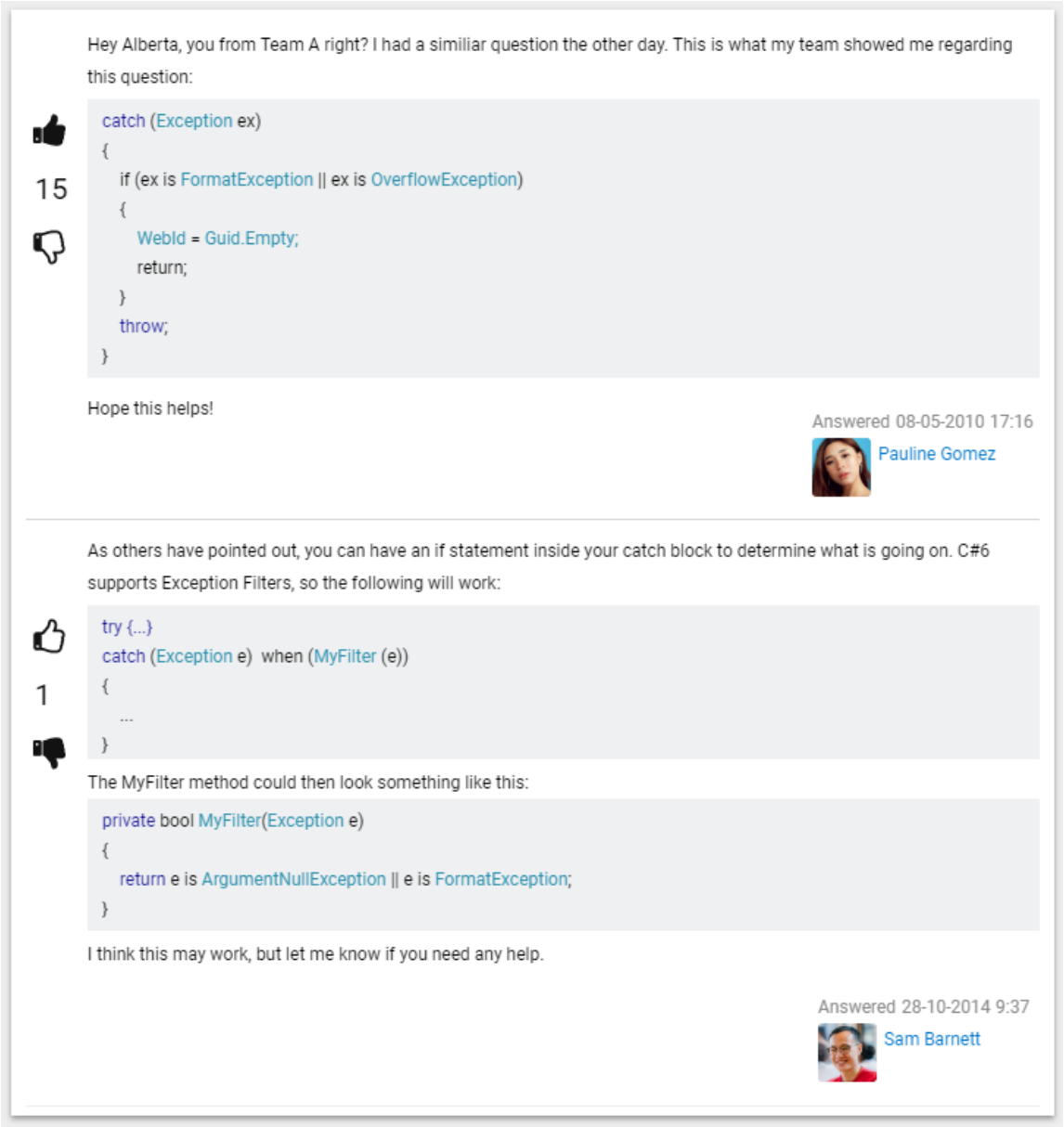


Figure 18: Prototype design – Q&A multiple answer blocks

4.2.3.1.4 Your Answer Block

The Q&A section would not be possible without the ability of an employee to write an answer to a question. Therefore, a rich textbox for employees to enter their answer is required. Figure 19 shows how the employee can enter text for an answer. The final design would include more text styling options. This could include options such as adding attachments or adding comment blocks for code.

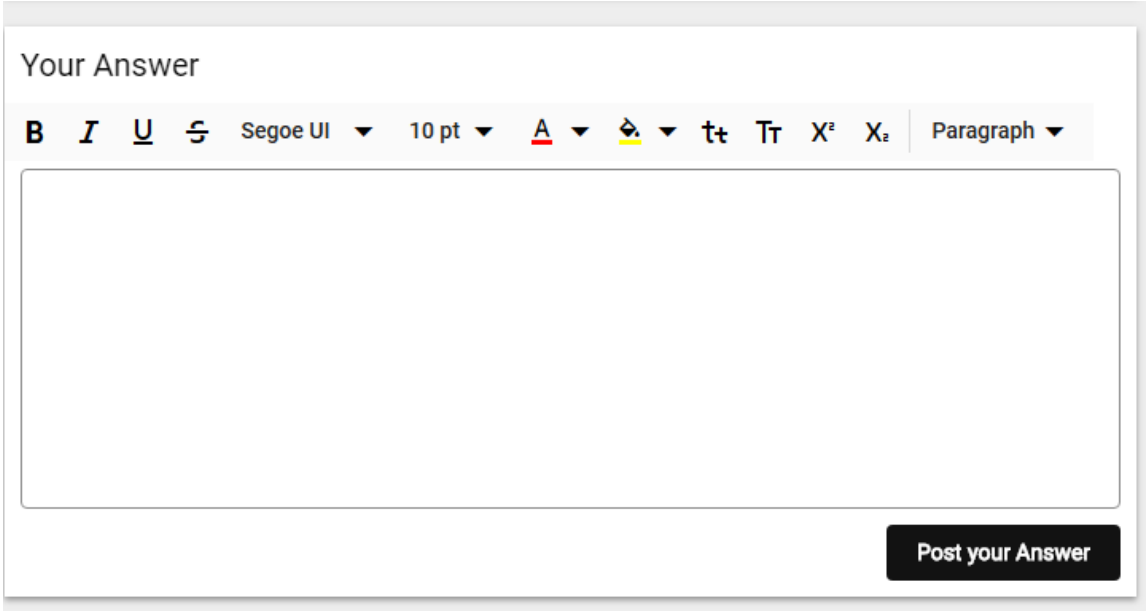


Figure 19: Prototype design – Your Q&A answer block

4.2.3.1.5 Related Issues

On the right-hand side (Figure 20), below a helpful description of the Q&A section, is a list of possible related questions. These related questions are based on the tags defined for the question.

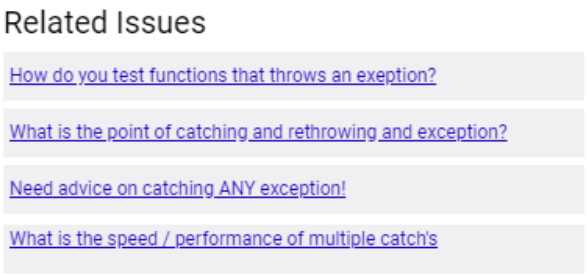


Figure 20: Prototype design – Q&A related issues

4.2.3.2. WIKI Site

The wiki section of the prototype is a place for employees and teams to add and edit valuable content, including graphics, tables and interactive components, to one central location. This content may relate to certain aspects that are relevant to only their team but may be useful for other teams to view. While it is known that WIKI's are "web pages' that can be quickly created without review or modification, this system would incorporate some level of editing and reviewing. The WIKI section is divided into the following areas:

1. Organisation dashboard
2. Team dashboard
3. Wiki pages

Figure 21 shows how the WIKI dashboard looks, followed by a breakdown of each section below.

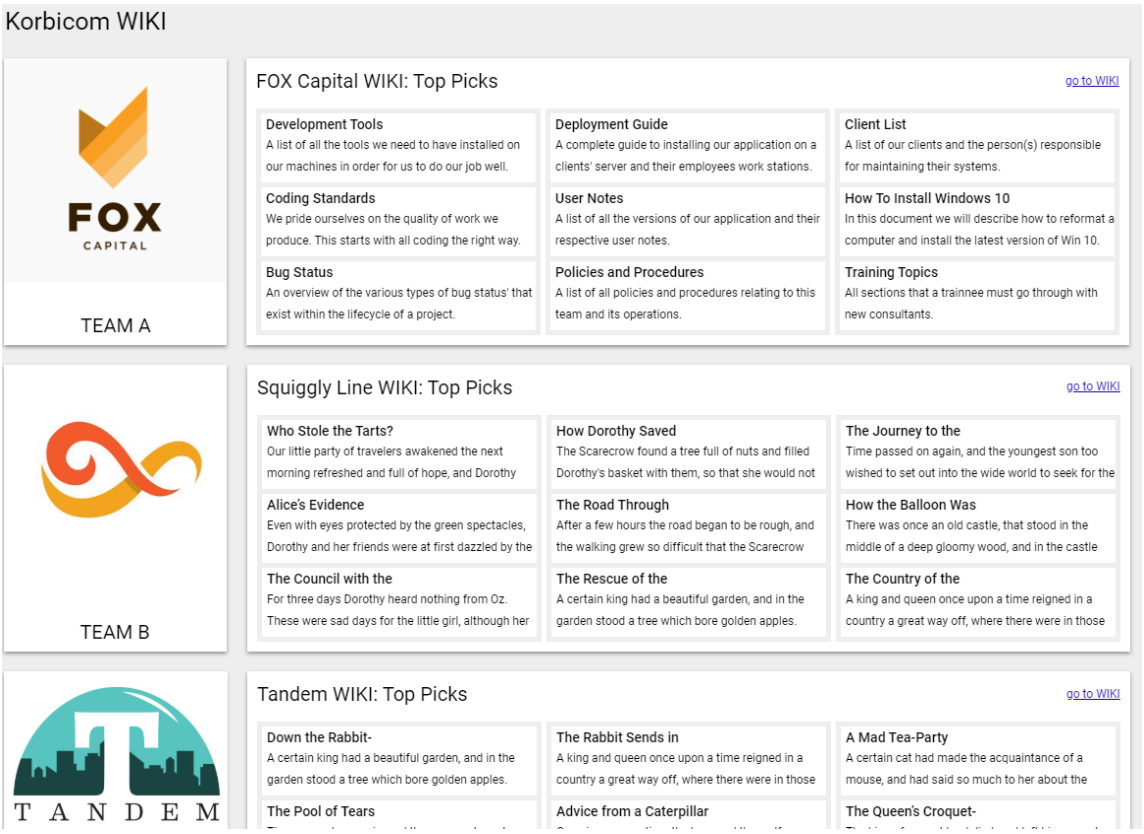


Figure 21: Prototype design – WIKI

4.2.3.2.1 Organisation Dashboard

When entering the WIKI section, there will be an organisation dashboard. It features an overview of each teams' wiki pages, making it easy to view and gain access. It will calculate the most viewed wiki pages, and display the top nine in order. Throughout the prototype, three fictitious teams are present. They are:

1. Team A: FOX Capital
2. Team B: Squiggly Line
3. Team C: Tandem

In this organisational dashboard, there is also a wiki from management/human resources. It can contain important information, for example, information that affects all employees and may be relevant for new employees or for training them. Figure 22 shows an example of Management related wiki pages that may be relevant to any employee.

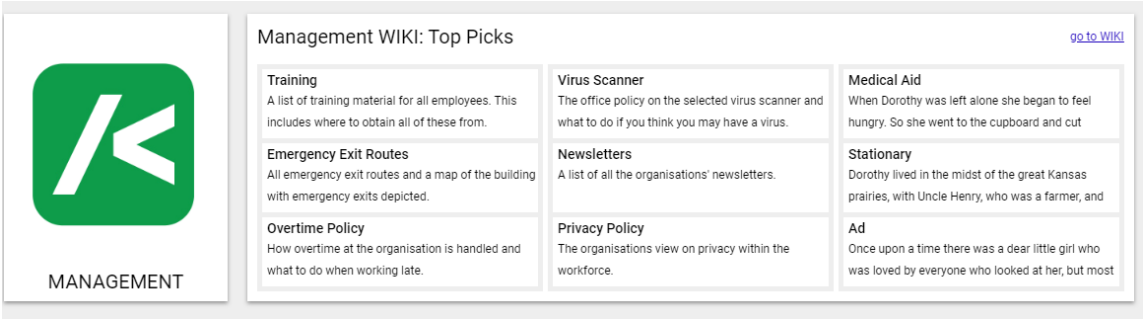


Figure 22: Prototype design – Management WIKI overview

During the evaluation phase, a participant suggested incorporating roles and security around the prototype, but due to its complexity and the prototyping tools limitations, it was not developed. The system will need to provide restrictions for certain pages and/or for team wikis. With this, it may then allow for more control over specific wiki sites.

4.2.3.2.2 Team Dashboard

The team dashboard displays a welcome page that features information regarding the team. Since this is a wiki page, it can contain any information that the team wants. On the left-hand side shows a list of each section within the wiki and their pages. These can be nested down to two levels.

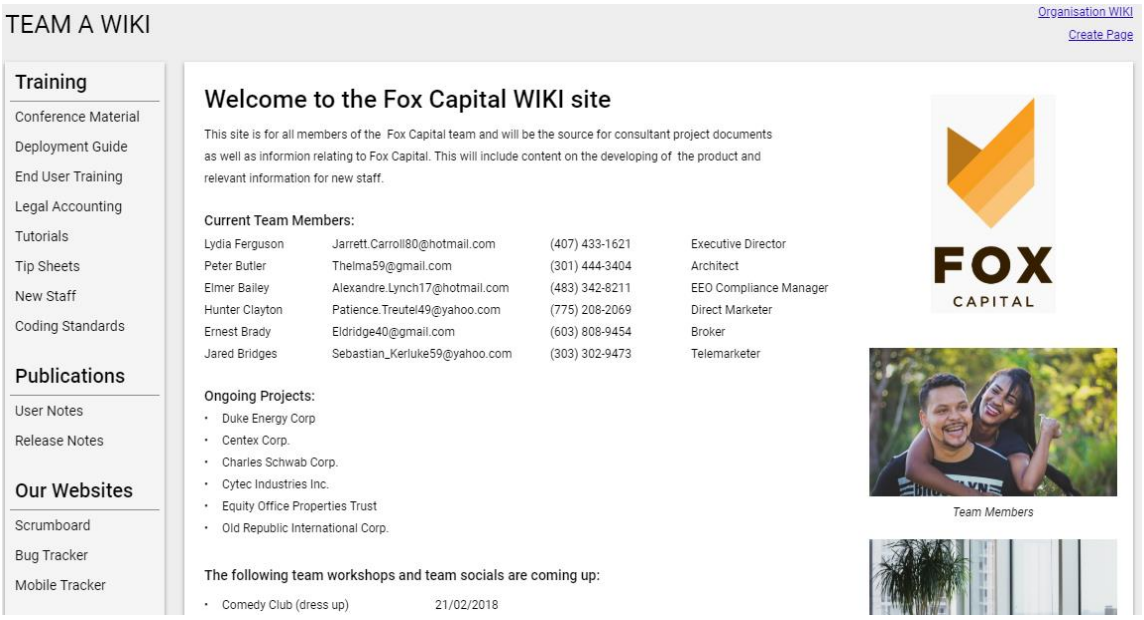


Figure 23: Prototype design – Team WIKI dashboard

4.2.3.2.3 WIKI Pages

Each wiki page can contain all relevant information specific to a topic. The idea is to allow an employee to create text and include graphs, graphics, tables and interactive components within the wiki page. Employees with a higher level (game level) may edit

and review wiki sites. This ensures that other employees who consult the wiki page are viewing quality information with minimal errors and factually correct data. When employees edit a page, the system notifies the page owner of the change and the editor receives points for their effort. Figure 24 shows an example of how a user could create a wiki page. It includes a place to enter the name of the section, a brief overview, a picture, and a place to write all relevant details.

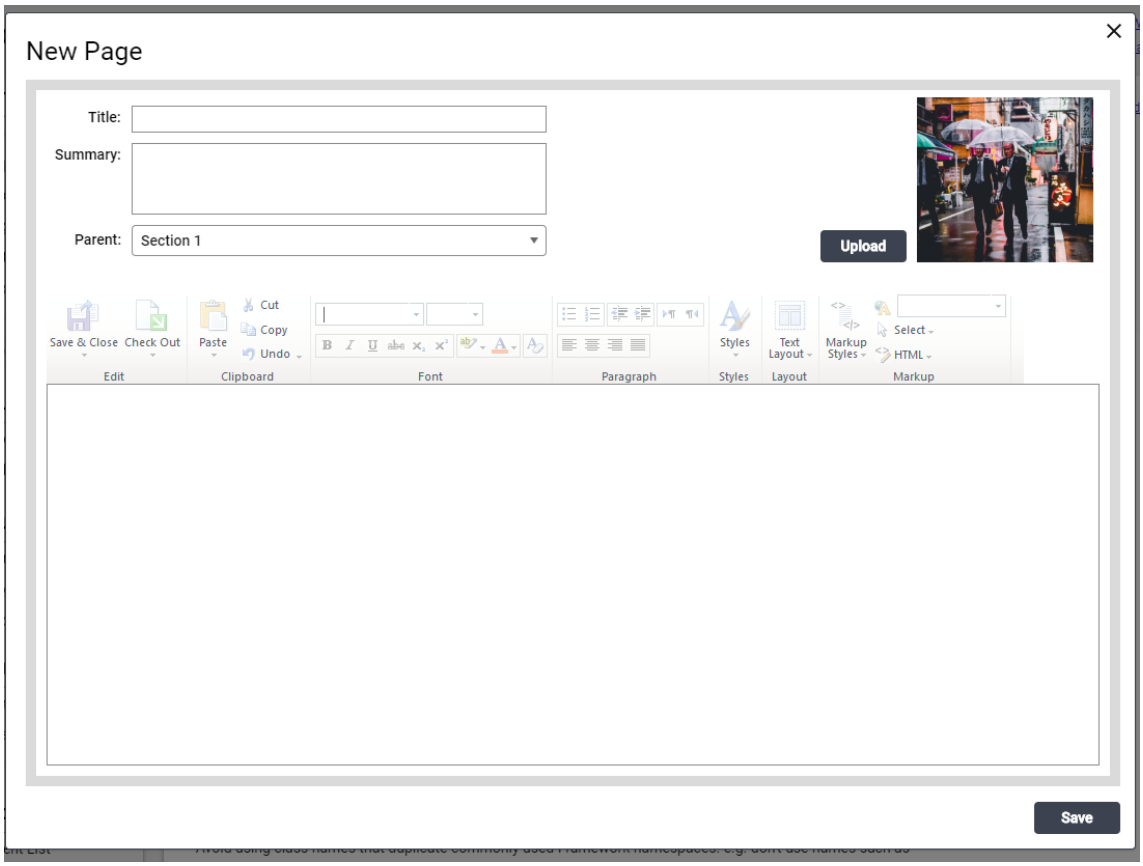


Figure 24: Prototype design – creating a WIKI page

4.2.3.3. Learning Academy

The learning academy is a place for employees to improve on their skills, and to learn new ones. Training employees holds many benefits, as discussed in the literature. One such benefit is that it increases employees' production value, increases their efficiency and reduces mistakes. The learning academy, Figure 25, contains the following sections:

1. Certificates and statistics
2. Enrolled courses
3. Recommended courses
4. Completed courses
5. Creating courses

The design of this section is loosely based on a platform called Udemy, a platform where students and professionals can learn new skills.

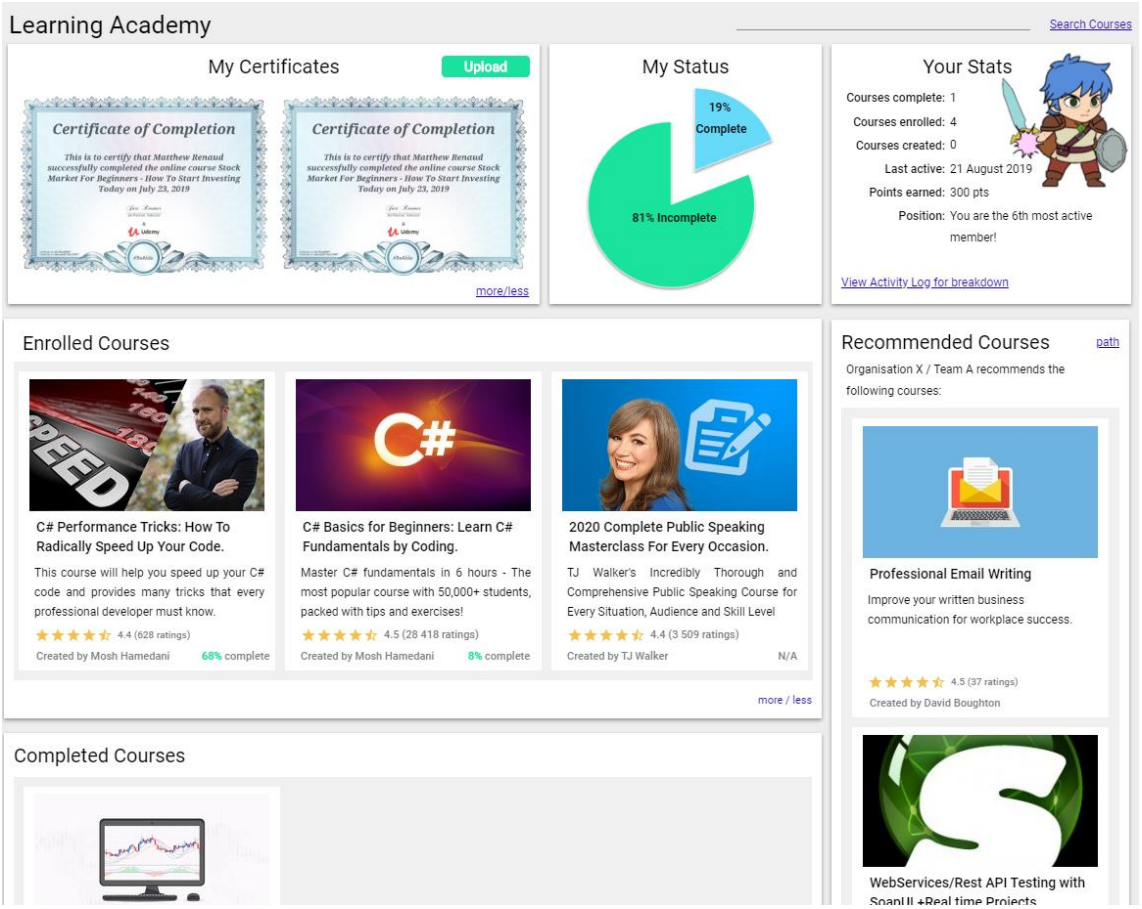


Figure 25: Prototype design – Learning academy overview

A course consists of lectures given by a person knowledgeable about that topic. Within a course, there may be videos, notes or tests to help a person gain knowledge. Within this prototype, employees skilled in a certain area may put together a course and offer it to others in the organisation. An example of where this may be used is in training new employees or training up clients on how to use a system developed by the organisation.

When entering the learning academy, an employee can see their progress in terms of the courses that they are currently enrolled in, and those that they have completed. They can also see gamification statistics relating to the learning academy. These include how many points they have earned and what position in the organisation they are in terms of member participation. The more they participate, contribute, and complete courses, the more points they earn.

To search through available courses, an employee would enter what they would like to learn into the search bar. In Figure 26 below is an example of the popup search results

when an employee searches for “Professional writing”. Once they have found what they would like, they can enrol in that course.

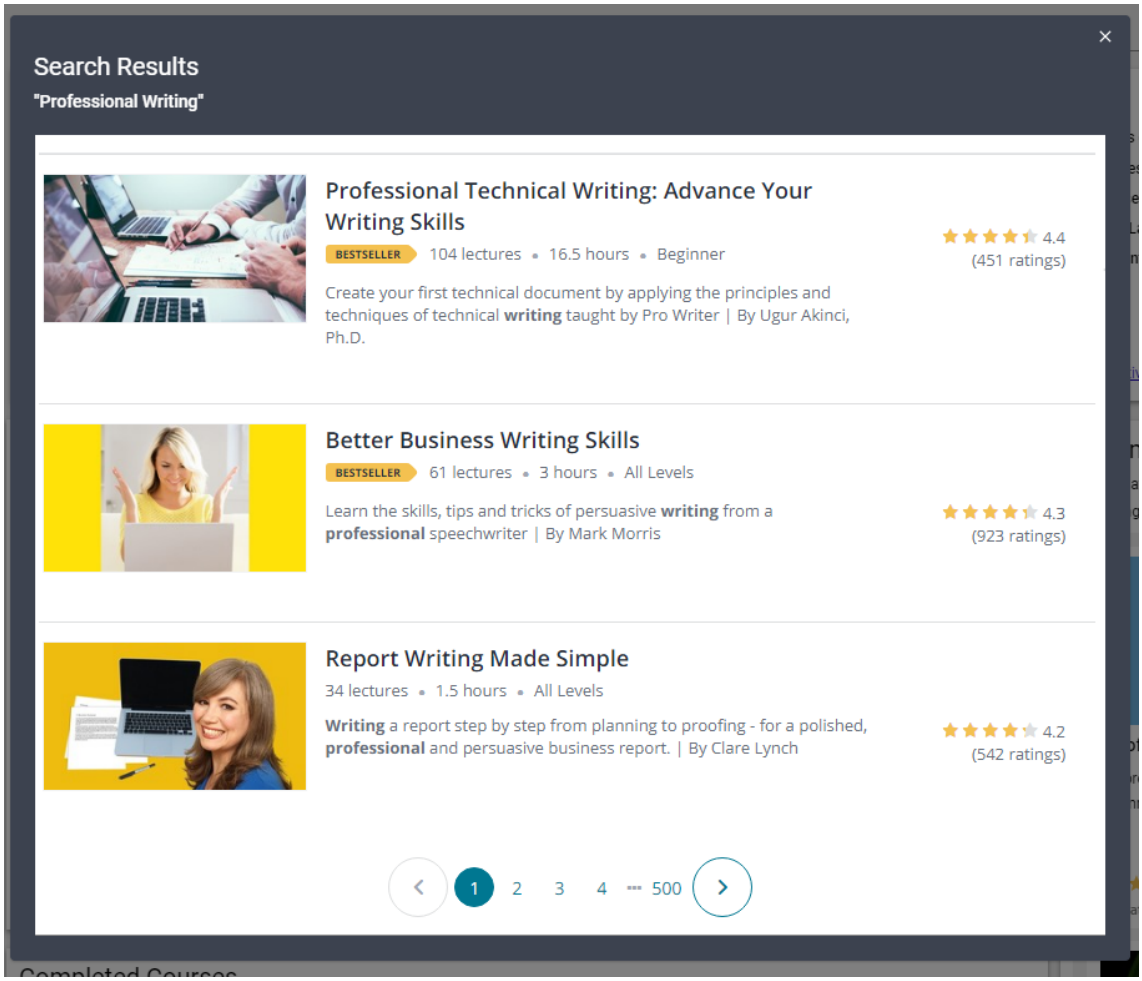


Figure 26: Prototype design – Search results for courses

When a user has enrolled in a course, they may begin to watch the lectures. Figure 27 shows an example of an enrolled course.

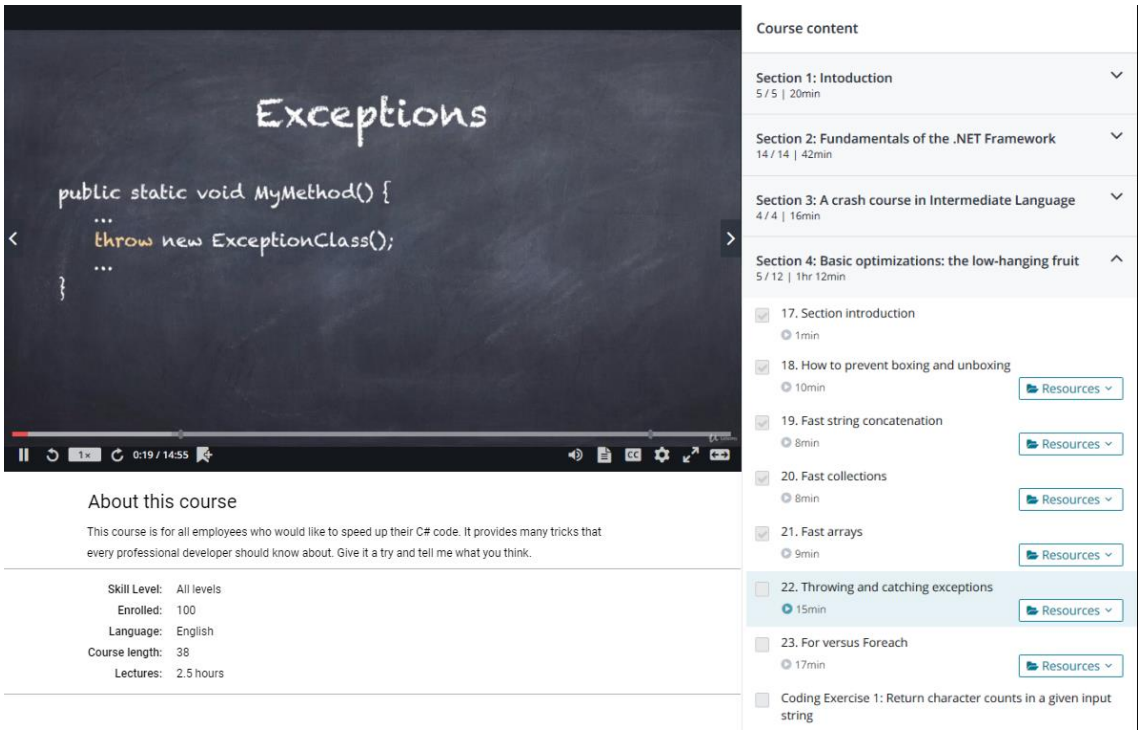


Figure 27: Prototype design – Taking a course in the Learning academy

When an employee has completed a course, they receive a certificate. They may then choose to upload it if they wish. These completed courses move from the enrolled section to the complete section at the bottom of the page.

Lastly, an organisation can define recommended courses for an employee to complete. This may be beneficial if the organisation wishes to set minimum requirements for an employee to complete in order to advance their career. For example, to become a senior software engineer, an employee may be required to complete certain courses or a certain amount of hours. Alternatively, for interns to become recognised by senior members.

Other key features of the learning academy section:

- Earn certificates by completing courses
- Organisational recommended courses to improve employees' professional capabilities
- Create courses for others to learn

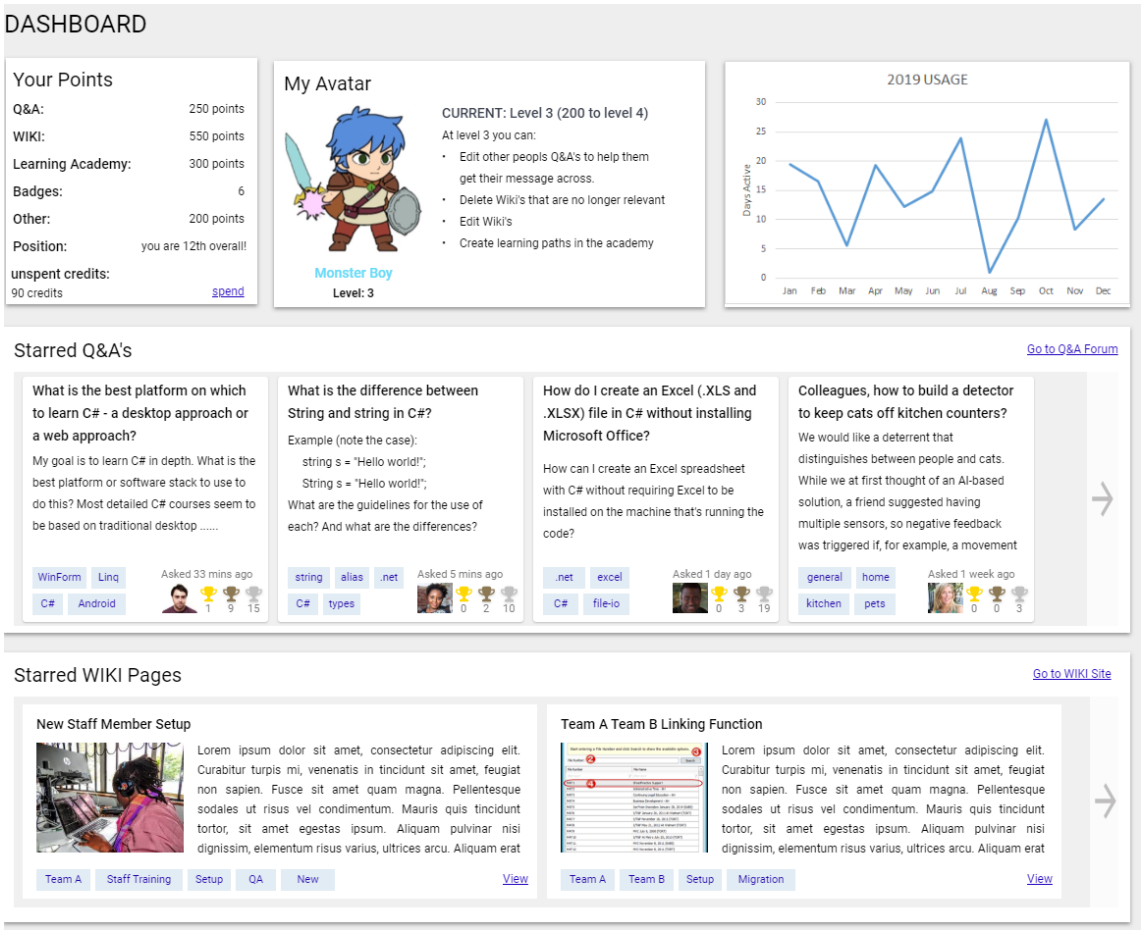
4.2.3.4. Dashboard

After demonstrating the prototype with employees, the suggestion to have a central dashboard came up. The dashboard aims to provide a quick, customizable place for employees to access information relevant to them without the need to search for what they want.

The dashboard (shown in Figure 28) consists of the four aforementioned sections:

1. Gamification context, called Activity Log
2. Q&A section
3. Wiki pages
4. Learning academy

These four sections are small summaries that are to be fully customizable. An employee can decide what to see in each section. For example, for the Q&A section, an employee may choose to see their starred Q&A's. For the wiki pages, they may choose to view the wiki pages they have created or those they have starred as well. For the learning academy, they may choose to view their enrolled courses. All these options are set up in the user settings page.



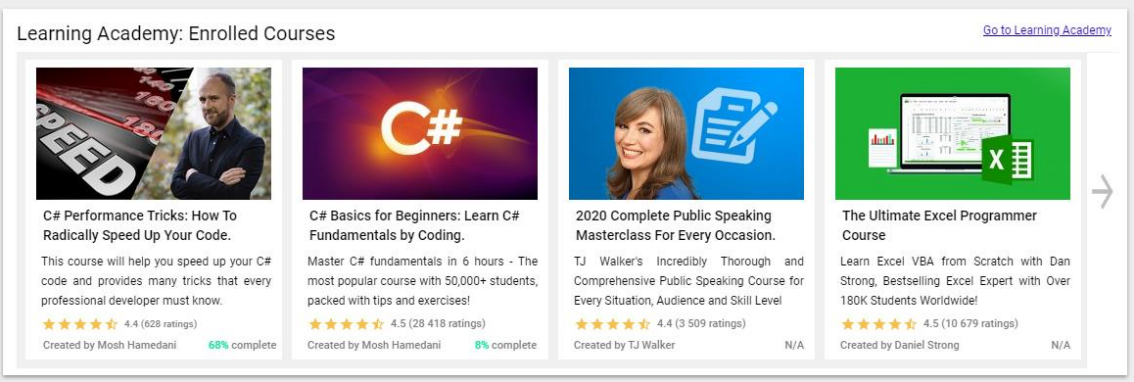


Figure 28: Prototype design – Dashboard overview

4.2.3.5. Chat Feature

One of the ways to strengthen communication in an organisation is to make it easier to chat. In this prototype, there is a team chat option and a global chat option. Team chat involves the people in your team and groups, consisting of your team members. The global chat consists of all the employees and groups where everyone can be involved. Some of the benefits of using "Instant Messaging" is that it reduces email traffic, helps connect remote teams, enables informal communication (think water cooler conversations) and maintains an archived message repository.

Examples of team chats can include groups on:

- A specific project
- A specific type of employee, e.g. Developers/Quality Analysts
- An informal chat area, for non-work-related chats
- Feature requests for products developed

Examples of group chats that may exist within an organisation include:

- Runners group – employees participating in a running group
- All engineers or employees of a specific type
- Members in an after-work social club
- All managers or partners of the organisation

In the prototype, an employee firstly can opt to participate in global chats. This is a setting in their user profile. Secondly, if they do not wish to be disturbed by notifications, they can set a “do not disturb” status. The prototype also allows an employee to convert a conversation (be it a group chat or a private chat) to a wiki page. This will strip out the text and place it in a new wiki page for them to edit. Figure 29 shows how the chat feature looks as well as an example of a fictitious conversation between two employees.

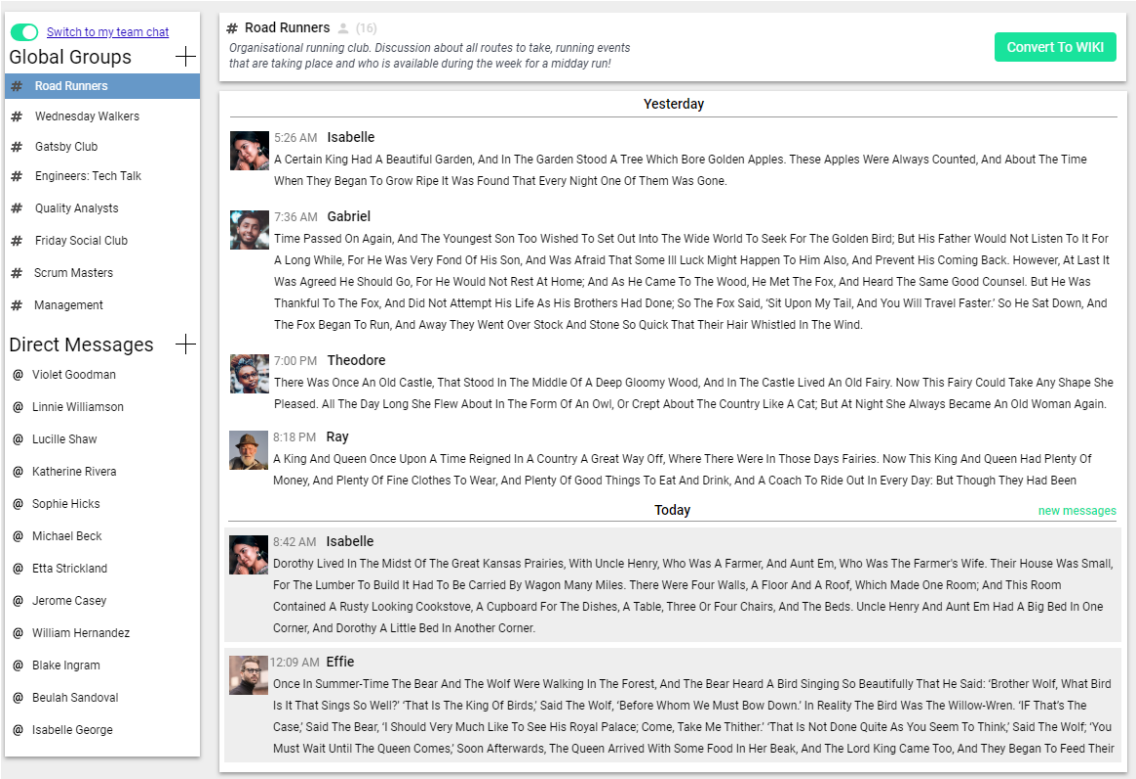


Figure 29: Prototype design – Chat feature

4.2.3.6. Search Functionality

A powerful feature of the system will be the ability to perform searches across the system. An employee may need to search for a course, something in a wiki page or something in a Q&A. While the prototype shows only a simplified version of searching, there is a great deal more that can enhance the search capabilities.

There is a search bar (Figure 30) at the top of the page in the header allowing the user to enter search text.

Figure 30: Prototype design – Search bar

In Figure 31, is an example of a user who has entered “New developer onboarding process”. Here you can see results for a wiki page, a Q&A, and a course. They all relate to the search text.

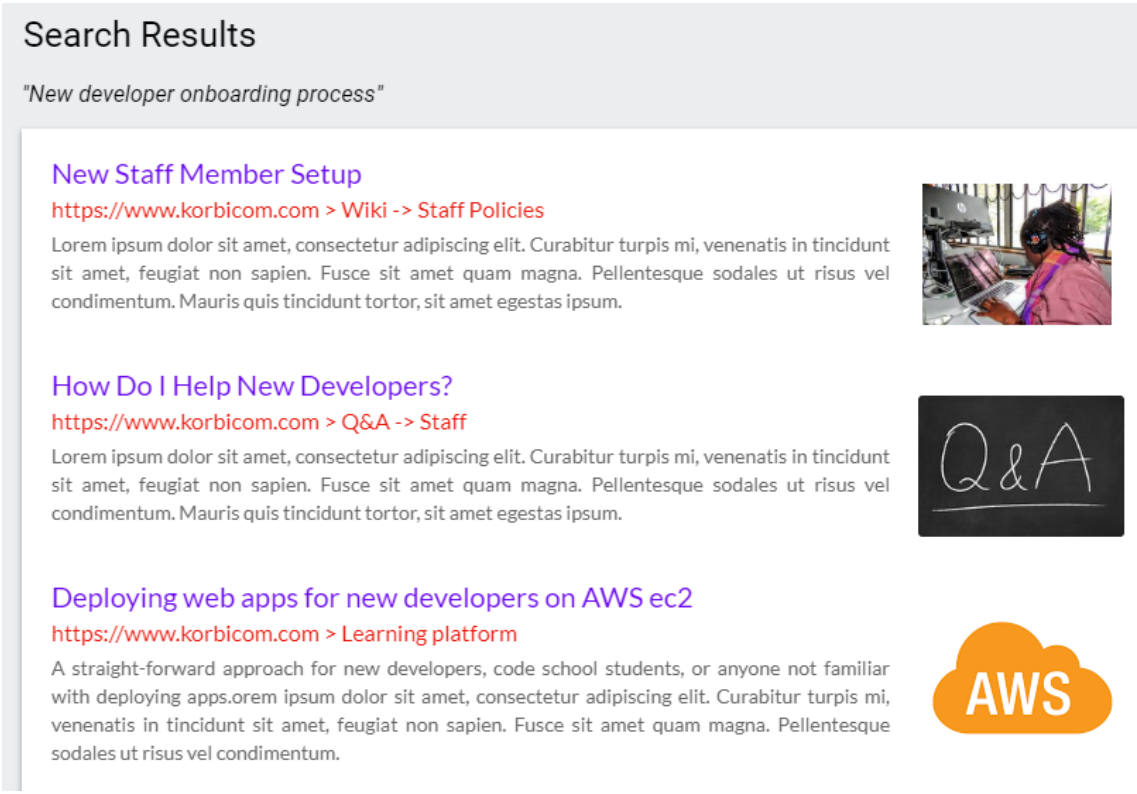


Figure 31: Prototype design – Search results

4.2.3.7. Notifications

Notifications can come from two different places. They may be notifications from the system itself or triggered from a variety of events, such as a pending message from the chats or a mention in a Q&A. Adding more events where notifications may occur makes the system more powerful. It enables an employee entering the system for the first time to view a summary of all notifications in one place. Below in Figure 32 is an example of the notification popup with two unread general notifications and two unread system notifications.

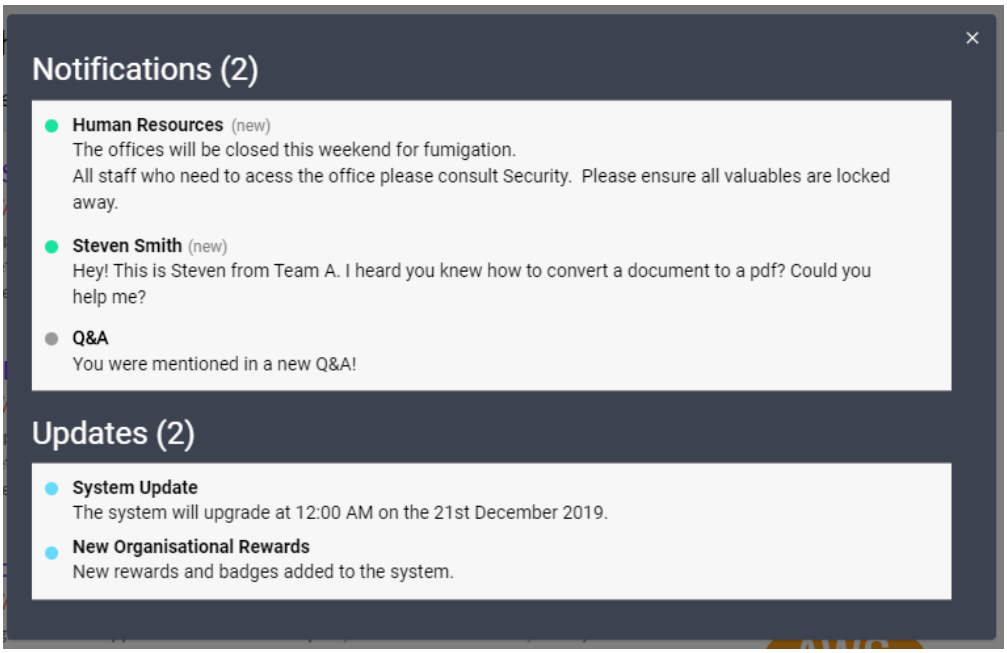


Figure 32: Prototype design – Notifications dialogue

4.2.3.8. Gamification

In the prototype, there is a page called Activity Log. This is where the elements of gamification are and where the employee may view it. This section consists of a variety of gamification elements and features aimed to motivate employees, intrinsically and extrinsically.

4.2.3.8.1 Avatar

At the top of the page is a breakdown of the points earned from each section. The top section also includes helpful information on what is happening as shown in Figure 33. An employee earns points by using the features across the system. These points earned help “grow” your avatar, which is a character that develops after each level is reached.

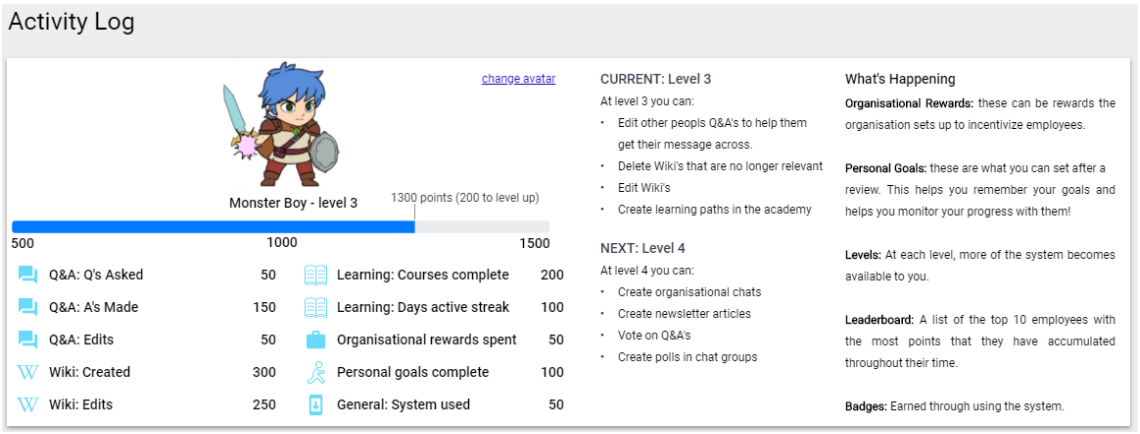


Figure 33: Prototype design – Gamification avatar

When a person has earned enough points to level up, they will receive a popup similar to the image in Figure 34. This indicates to the employee that their character has grown and that they have increased their level.

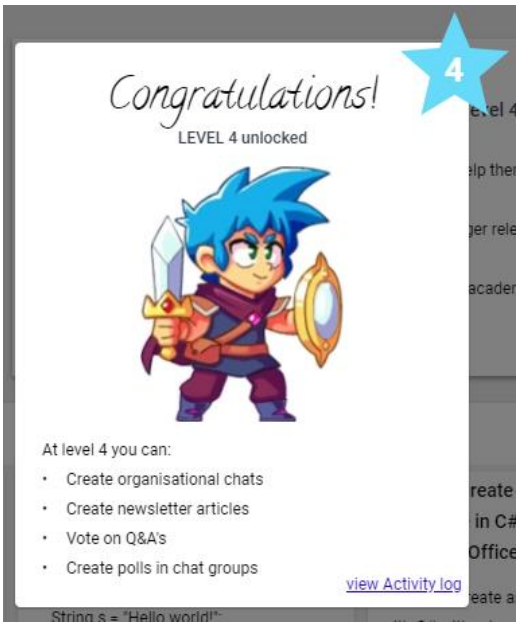


Figure 34: Prototype design – Avatar level-up preview

Each level exposes more functionality of the system. For example, at level four, an employee can start to create organisational chats or vote on Q&A's. At another level, for example, they can edit wiki pages and delete them. By doing this, it prevents inexperienced employees from making large changes and provides a level of intrigue and motivation to keep using the system.

4.2.3.8.2 Rewards & Goals

The system allows the organisation to set up rewards for its employees. The organisation may choose to reward the employees who are consistently sharing knowledge and contributing to the organisational body of knowledge. Within the system, an employee may earn "credits". This is the currency to buy the rewards offered by an organisation. In Figure 35 below, the organisation has chosen to provide three different types of rewards:

1. Voucher for coffee at a coffee shop
2. Voucher for a cooking class
3. Voucher for a wine hamper

The employee may then choose to "buy" one or more of these rewards with their credits.

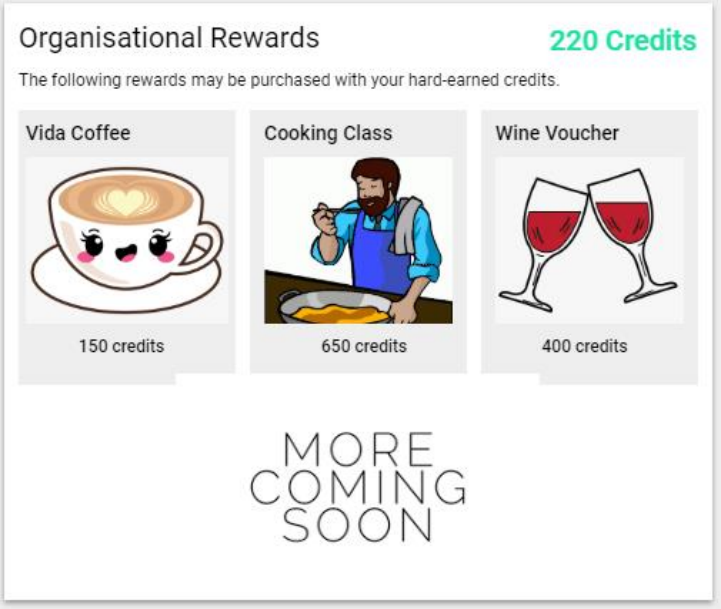


Figure 35: Prototype design – Organisational rewards

Employees may also choose to set up personal goals that they wish to achieve. They can then update the progress of reaching that goal as often they wish. The power of this is that their manager can refer to this in the employees' yearly-review. The manager may also help set up these goals with the employee based off of their review and what they may need to accomplish before the next review. Figure 36 shows an employee who has set up three personal goals.

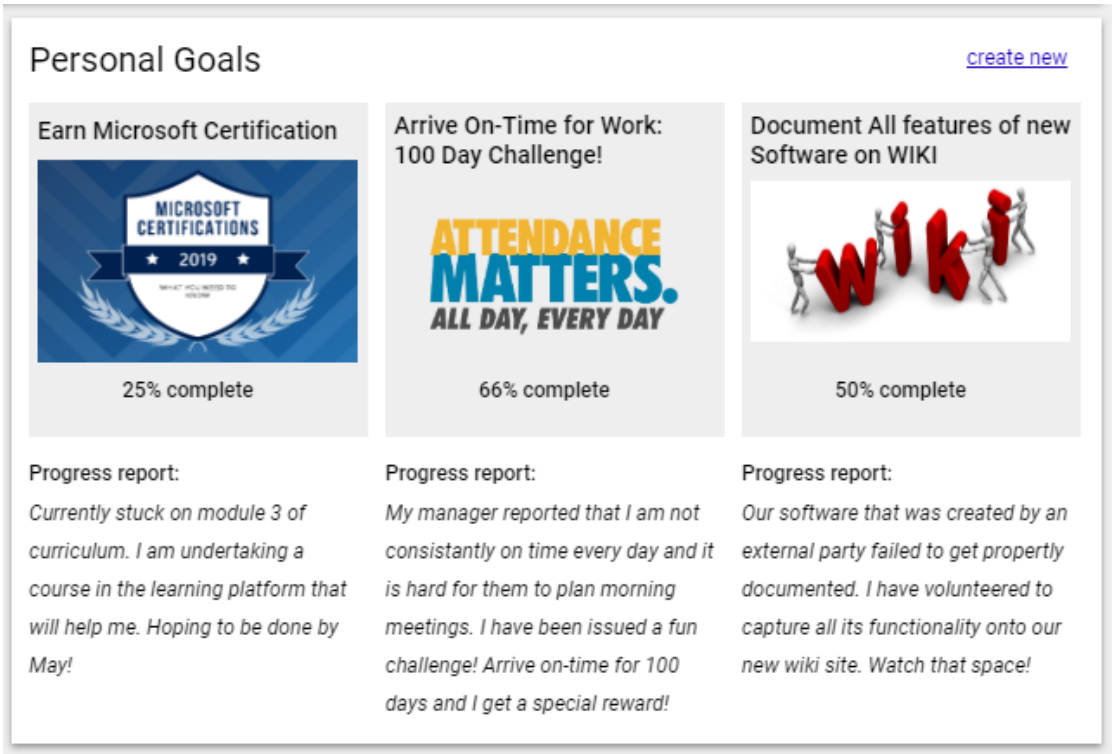


Figure 36: Prototype design – Setting up personal goals

4.2.3.8.3 Leaderboard

The leader board (shown in Figure 37, where all names are fictitious) is not just a gamification mechanism in this system. It helps to identify what each employees' top skills are or what part of the system they have used the most. If another employee needs assistance, this is a great place to visit to identify who may be able to help him or her.

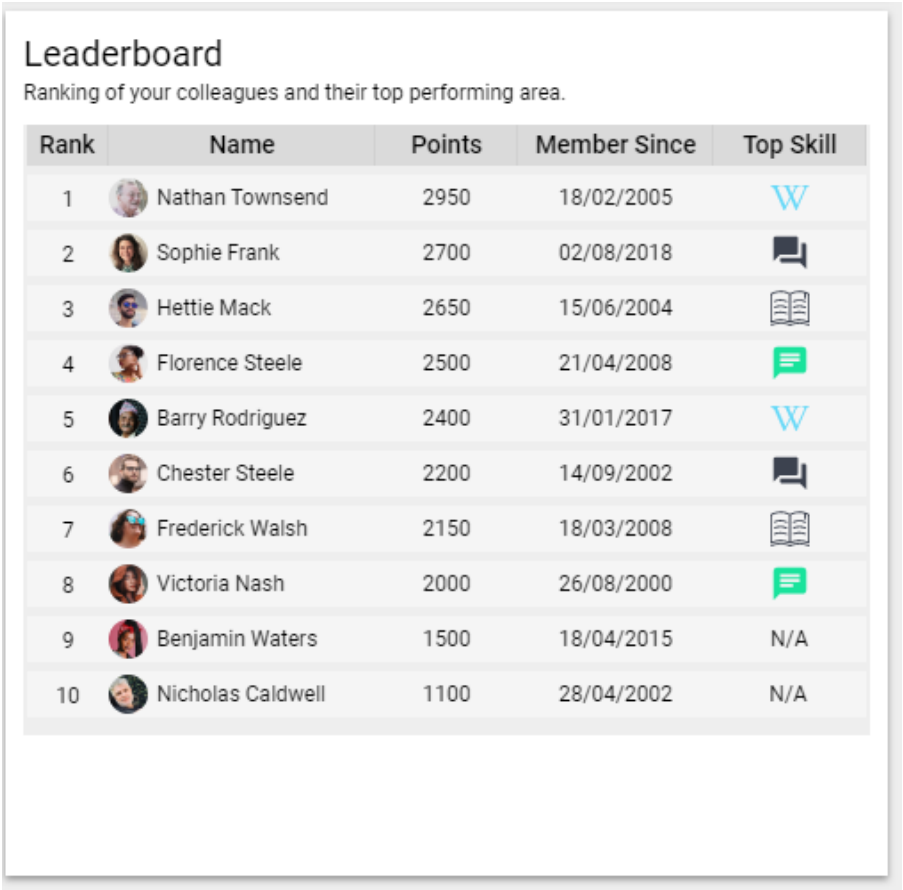


Figure 37: Prototype design – Gamification leaderboard

4.2.3.8.4 Badges

Badges provide feedback to the employee. They help reward employees who have achieved something or have reached a milestone. Badges boost employees' ego, and lets employees boast about them in front of colleagues. Within this system, badges are shown alongside their name in the learning academy and can be placed in other places where their name is visible. Below in Figure 38 is an example of possible badges an employee may have earned.

Figure 38: Prototype design – Gamification badges

4.2.4. Activity 4: Demonstration

After presenting the initial prototype to a select random group of employees representing three different teams within the organisation, there were recommendations on what would help reach the desired goal. This includes the necessary changes as a result of the outcomes of the evaluation phase.

The following is a detailed breakdown of the features shown in the first and second iteration of development:

4.2.4.1. Phase 1 features:

- Q&A Section
  - Creating, editing, deleting Q&A's
  - List of all Q&A's
  - Q&A's grouped by tags
  - Up-voting/Down-voting answers and Q&A's
  - Marking Q&A as a favourite
- WIKI Section
  - Team dashboard with an overview page
  - List of all wiki sites (pages) in a list

    - Editing/deleting/creating a wiki page and assigning to group/section
- Learning Platform Section
    - Search for courses
    - Create courses
    - Show enrolled courses & completed courses
    - Organisational recommended courses
- Gamification (called Activity Log)
    - Earn points for using each section
    - Earn credits (currency) for special events
    - Leaderboard to show each employees speciality (most used feature)
    - Incorporate an avatar (game element)
    - Include levelling and unlocking of certain features for different levels
    - Organisational rewards
    - Personal goal achiever
    - Badges
- Other
    - User settings
    - Search across system
    - Chat (IMS) functionality across the organisation

4.2.4.2. Phase 2 additional features:

- Q&A
    - Filtering in Q&A by specific options
    - Ability to create threads for each answer (allowing the discussion of each answer)
    - Link to Activity Log
- Learning Platform Section
    - Link to Activity Log
- WIKI Section
    - WIKI dashboard of all teams pages & an HR wiki
    - 2x subfolders for wiki sections – allow for wiki pages to go into subfolders
- Central Dashboard
    - Feature-starred Q&A's, WIKI's
    - Summary of Learning Platform
    - Customizable in User Settings
- Separate chats for organisation + internal team
- Organisational Newsletters

- Able to log a (technical) support ticket
- Access your storage drive (Google/One Drive)

4.2.5. Activity 5: Artefact evaluation

The study of gamification as a motivational tool for knowledge sharing evaluates the prototype artefact by means of Goal Question Metric (GQM). The following sections break down each part of the GQM approach and details how the researcher used it to evaluate the artefact.

4.2.5.1. Goal (G)

The goal of the artefact is to improve employee motivation to share knowledge within their team and other teams. This goal aligns with the research problem discussed in Chapter 1 of this paper.

4.2.5.2. Question (Q)

The following questions have been created that if answered, show whether the goal has been met or not:

1. How is motivation for knowledge sharing affected within and across teams?
2. What impact does the gamified knowledge-sharing prototype have on employees' motivation to share knowledge?
3. What effect does the gamified knowledge-sharing prototype have on knowledge collecting?
4. What effect does the gamified knowledge-sharing prototype have on knowledge donating?

The first question ties in with the second research question and the second question links to the fourth research question in the Research Questions section in Chapter 1 of this paper. Therefore, by answering these questions, it answers this papers research questions.

The third and fourth questions above tie into the first and second sub-sections of the questionnaire from Activity 1 of the Design Science Research process. The first Activity of the DSR process was to identify the problem and motivate for a solution. The first sub-section was evaluating employees willingness to accept knowledge (knowledge collecting), and the second sub-section evaluated employees' willingness to share knowledge and communicate knowledge to others (knowledge donating).

By answering these questions, the researcher knows whether the prototype is a solution to the problem.

4.2.5.3. Metrics (M)

To answer the questions by quantifiable means, the researcher established twenty-one metrics for the four questions. Listed below are the focus areas for each of the established questions. The researcher then used these focus areas of the prototype to create statements (Likert items) that an employee can respond to by rating it on a scale.

4.2.5.3.1 Question 1

- Storing team information and knowledge
- Retrieving knowledge from other teams
- Collaborating to produce knowledge
- Motivation to contribute knowledge
- Difficulty accessing & viewing teams knowledge
- Motivation to use team knowledge

4.2.5.3.2 Question 2

- Motivation from leaderboard changes
- Level of effort input for extrinsic reward
- Engagement of the avatar in levelling up
- Motivation from gamification elements
- The usefulness of intrinsic rewards

4.2.5.3.3 Question 3

- Efficiency retrieving knowledge per topic
- Efficiency searching for knowledge
- Processes & mechanisms for gathering knowledge
- Ability to consult other employees
- Likelihood to receive knowledge more often

4.2.5.3.4 Question 4

- Effectiveness of discussing knowledge items
- Ability to communicate to employees in other teams
- Chat feature to share knowledge
- Effectiveness of communicating
- Volunteering to help others

Table 4 describes how each of the above twenty-one metrics is measured in the questionnaire.

Table 4: Descriptions of Metrics for GQM

#	Metric	Weighted Question
M1	Storing team information and knowledge	How effective is the prototype at storing your teams' information and collective knowledge?
M2	Retrieving knowledge from other teams	How efficiently can you retrieve knowledge from another team using the prototype?
M3	Collaborating to produce knowledge	Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?
M4	Motivation to contribute knowledge	Are you more likely to share knowledge on the system for members of other teams to view?
M5	Difficulty accessing/viewing teams knowledge	Does the system make it easy to access and view other teams' work-related knowledge?
M6	Motivation to use team knowledge	Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?
M7	Motivation from leaderboard changes	Will your motivation be affected by moving either up or down on a leaderboard?
M8	Level of effort input for extrinsic reward	Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?
M9	Engagement of the avatar in levelling up	How engaging do you find the use of the avatar to level up and unlock new features of the system?
M10	Motivation from gamification elements	Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?
M11	The usefulness of intrinsic rewards	Would you find benefit in the personal goal-setting feature and its associated rewards?
M12	Efficiency retrieving knowledge per topic	How efficiently can you retrieve knowledge for a specific topic?
M13	Efficiency searching for knowledge	How efficient is the prototypes' ability to search for team knowledge compared to

		anexisting system currently in place?
M14	Processes & mechanisms for gathering knowledge	Within the system are there sufficient processes and mechanisms for gathering information and knowledge?
M15	Ability to consult other employees	How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?
M16	Likelihood to receive knowledge more often	Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?
M17	Effectiveness of discussing knowledge items	How effective is the prototype at enabling colleagues to discuss and share each other's' work-related knowledge?
M18	Ability to communicate to employees in other teams	How effective is the prototype at encouraging communication between members of the same team and across other teams?
M19	Chat feature to share knowledge	Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?
M20	Effectiveness of communicating	Will increased communication between colleagues encourage you to share your knowledge gained through work experience?
M21	Volunteering to help others	Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?

Figure 39 shows a visual representation of how the goal, questions and metrics fit together and form the GQM model.

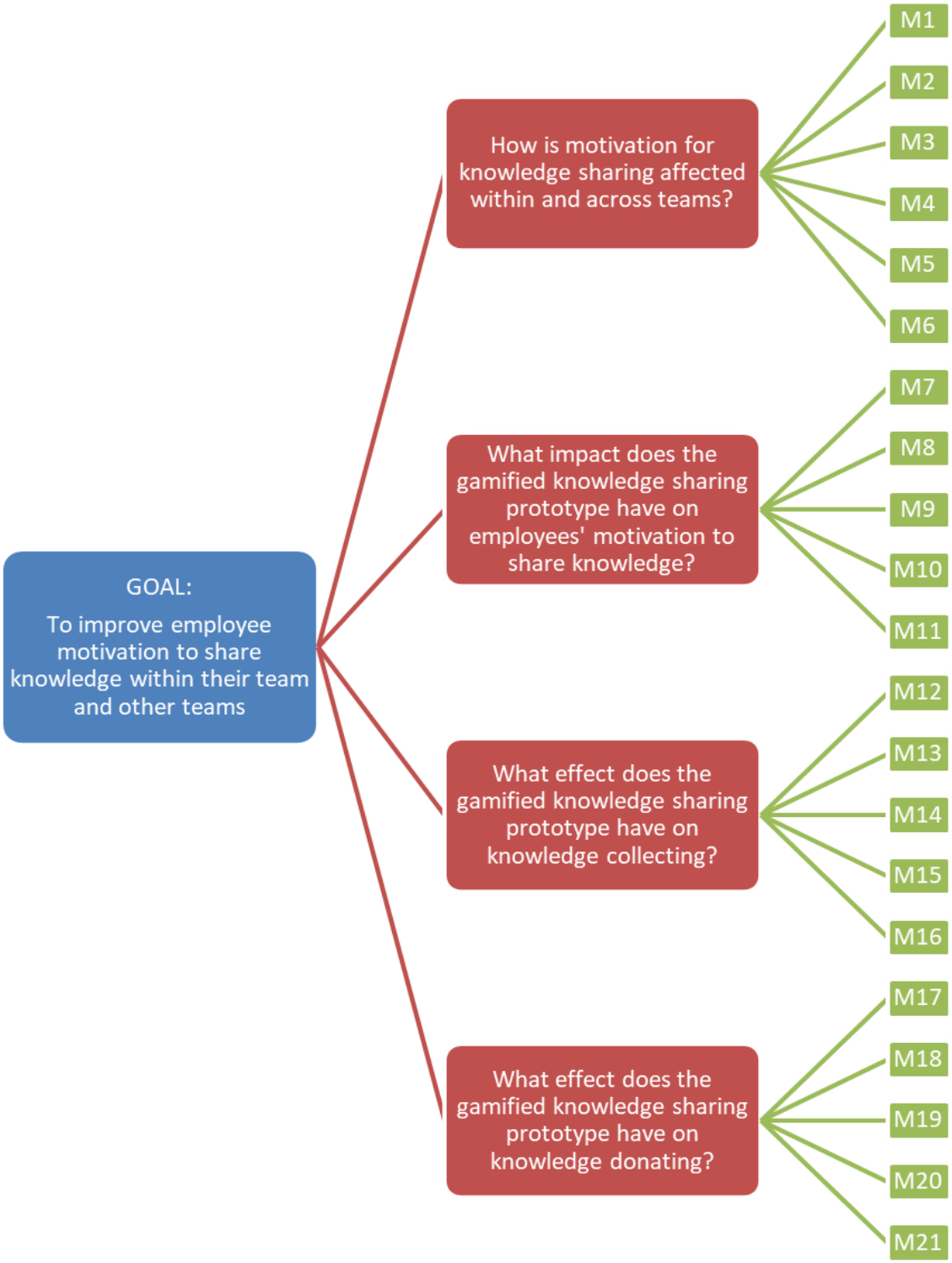


Figure 39: GQM hierarchy for evaluating artefact

4.2.5.4. Metrics questionnaire

Appendix E shows the layout of the survey each employee received during the interview. Firstly, the researcher walks the employee through the prototype, followed by completing the questionnaire and addressing any additional questions or feedback that they may have.

4.2.5.5. Evaluation results

Each of the interviews consisted of a one-hour demonstration, which was largely due to the numerous intricate features available in the prototype. The questionnaires were well accepted and there were no issues reported by the participants.

This Likert scale data is ordinal, therefore, one should not perform arithmetic operations it (Wu and Leung, 2017), which means one cannot calculate a mean or standard deviation without some analytical issue or comprising the scale validity and its reliability. According to a majority of researchers (Stratton, 2018; Hassler, 2018), it is more appropriate to describe ordinal data by its mean, mode and quartiles. Therefore, as opposed to including standard deviation and mean, the researcher has identified in the results the median response and interquartile range for each measured metric.

While the researcher acknowledges the above, since this questionnaire is measuring whether the artefact is quantifiably effective (yes or no), a rating system is applied. If Disagree/Strongly Disagree were given a score of 0 (representing goal not achieved), Agree/Strongly Agree were given a score of 2 (representing goal achieved) and Neutral given a score of 1, the researcher can then deduce a “score” for each metric item. If all Likert items are above 50%, they pass and the next phase of DSR may commence. Table 7 shows the overall results for each question, an average score of the metrics underneath it. View Table 6 for a visual representation of the scoring used.

Table 5 shows the responses to the Likert questions presented to the employees. The results from the 10 participants are shown in Appendix F.

Table 5: Likert analysis of organisations response to the prototype

	Question 1						Question 2					Question 3					Question 4				
	Likert Item 1	Likert Item 2	Likert Item 3	Likert Item 4	Likert Item 5	Likert Item 6	Likert Item 7	Likert Item 8	Likert Item 9	Likert Item 10	Likert Item 11	Likert Item 12	Likert Item 13	Likert Item 14	Likert Item 15	Likert Item 16	Likert Item 17	Likert Item 18	Likert Item 19	Likert Item 20	Likert Item 21
	How effective is the prototype at storing your teams' information and collective knowledge?	How efficiently can you retrieve knowledge from another team using the prototype?	Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?	Are you more likely to share knowledge on the system for members of other teams to view?	Does the system make it easy to access and view other teams' work-related knowledge?	Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?	Will your motivation be affected by moving either up or down on a leaderboard?	Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	How engaging do you find the use of the avatar to level up and unlock new features of the system?	Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	Would you find benefit in the personal goal-setting feature and its associated rewards?	How efficiently can you retrieve knowledge for a specific topic?	How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	Within the system, are there sufficient processes and mechanisms for gathering information and knowledge?	How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	How effective is the prototype at enabling colleagues to discuss and share each other's work-related knowledge?	How effective is the prototype at encouraging communication between members of the same team and across other teams?	Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?
Participant 1	4	5	5	4	4	4	3	3	4	3	4	5	5	4	4	5	4	4	4	4	4
Participant 2	4	4	4	4	4	4	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4
Participant 3	4	4	5	4	4	4	4	4	4	4	5	4	5	4	5	5	4	5	5	4	5
Participant 4	3	4	5	3	4	5	4	4	5	4	4	3	5	5	3	4	5	3	3	3	5
Participant 5	5	3	4	4	4	4	4	4	4	4	3	4	4	5	4	5	4	4	5	4	5
Participant 6	4	3	5	3	4	3	4	4	3	5	3	3	5	4	5	4	4	5	3	3	4
Participant 7	4	5	5	5	4	4	3	5	5	5	4	3	5	3	3	3	5	4	3	3	3
Participant 8	5	3	4	4	3	4	4	5	4	4	4	4	3	4	4	4	4	3	3	5	3
Participant 9	5	3	5	5	3	3	3	5	3	5	4	4	4	4	5	4	3	4	4	5	4
Participant 10	5	3	4	4	5	5	3	5	3	3	4	4	4	4	3	5	4	4	5	4	4

Complete responses	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Blank responses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of responses	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Median response	4	3.5	5	4	4	4	3.5	4	4	4	4	4	4.5	4	4	4	4	4	4	4	4
Interquartile range	1	1	1	0	0	0	1	1	1	1.5	0	0.75	1	0	1.5	1	0	0	1.75	0.75	0.75
Metric score	95%	75%	100%	90%	90%	90%	75%	95%	80%	85%	90%	85%	95%	95%	85%	95%	95%	90%	80%	85%	90%
Response Count																					
Strongly Disagree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Disagree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Neutral	1	5	0	2	2	2	5	1	4	3	2	3	1	1	3	1	1	2	4	3	2
Agree	5	3	4	6	7	6	5	5	4	4	7	6	4	7	4	5	7	6	3	5	5
Strongly Agree	4	2	6	2	1	2	0	4	2	3	1	1	5	2	3	4	2	2	3	2	3
Total	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Response %																					
Strongly Disagree	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Disagree	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Neutral	10%	50%	0%	20%	20%	20%	50%	10%	40%	30%	20%	30%	10%	10%	30%	10%	10%	20%	40%	30%	20%
Agree	50%	30%	40%	60%	70%	60%	50%	50%	40%	40%	70%	60%	40%	70%	40%	50%	70%	60%	30%	50%	50%
Strongly Agree	40%	20%	60%	20%	10%	20%	0%	40%	20%	30%	10%	10%	50%	20%	30%	40%	20%	20%	30%	20%	30%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6: Likert Scale Scoring

Strongly Disagree	0
Disagree	0
Neutral	1
Agree	2
Strongly Agree	2

Table 7: Overall score for each "GQM" Question

Question 1	90%
Question 2	85%
Question 3	91%
Question 4	88%

4.3 Chapter summary

Chapter four details the results from the performed research method. It documents the outcomes of each activity of the Design Science Research process. Each of the activities required completing in sequence, with each activity affecting the ensuing activity.

The researcher identifies the problem within the context organisation, objectives for a solution are created based off the findings, an artefact is designed and then demonstrated to participants, followed lastly by an evaluation process via a method called Goal Question Metric. The design phase undergoes two cycles to ensure that it meets the goal and its participants are satisfied.

The following chapter analyses the results and details how it answers the research questions.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

In Chapter 1, the researcher introduces the reader to the research problem. The identified problem is that organisations fail to put in place a suitable system that motivates employees to share their work-related knowledge between teams. They also fail to put in place an adequate system that lets them easily find and process available organisation knowledge. They do not pay attention to factors that influence individuals' motivation and allowing them the time to contribute to knowledge sharing activities in the organisation. This study began by identifying the problem within an organisation consisting of multiple teams, followed by developing a prototype for a solution that enables knowledge sharing using gamification as a motivational tool. The prototype bases its knowledge gained through previous research discussed in Chapter 2.

This study comprises of multiple research contributions. The contribution of the artefact by way of the prototype is accompanied by empirical evaluations. The following are the major empirical research contributions.

1. How to develop an application to positively affect motivation for knowledge sharing between teams
    a. Including how to efficiently retrieve and store knowledge
2. Gamification can be successfully used to promote knowledge sharing between teams
3. Not all gamification elements work at motivating employees
    a. Using a leaderboard (as a gamification element) will not necessarily affect their motivation to share knowledge positively
4. Employees feel less interested in tangible organisational rewards (extrinsic motivating factors) than personal goal-setting features and associated rewards (intrinsic motivating factors)
5. By providing chat functionality within the application, it will assist employees with receiving and sharing knowledge between teams
6. One single knowledge sharing system is better than multiple team systems
7. A gamified knowledge sharing system allows managers the ability to help promote employee growth
8. Management in this organisation does believe in the importance of knowledge sharing, despite what the literature states.

The following sections discuss the study further and answer the question of how gamification can help affect employee motivation to share knowledge within an organisation.

5.2 Research questions

To achieve the objectives defined in Chapter 1, and to answer the question of how gamification can help affect employee motivation to share knowledge, the researcher posed four sub-questions. They were as follows:

1. What is the impact of gamification elements on employees' motivation to share knowledge?
2. How is motivation for knowledge sharing affected across teams and within teams?
3. How can a prototype of a gamified system for knowledge sharing be developed for an organisation?
4. What impact does a gamified system have on employees' motivation to share knowledge?

The following sections discuss how the study has answered each question and how the results have furthered our understanding of the research problem.

5.2.1. The impact of gamification elements

The researcher predominantly answers this question from the literature gathered in Chapter 2, along with evaluating how participants engage with the elements in the prototype.

The following gamification element groups are used in the prototype:

- Achievement (progression) – includes points, badges, levelling, leaderboards, certificates
- Personalisation – includes avatar selection, avatar customisation, character naming
- Rewards – on an organisational level, and intrinsic rewards set by an employee

The literature in Chapter 2 discusses a variety of gamification elements that may help affect employees' motivation. These include popular known elements such as badges, leaderboards, and system points. Badges are important to note, as they can have an impact on employees in the sense that they can depict their achievements visually. This is especially helpful for new employees as it allows them to see what is possible within the system. In the developed prototype, badges were implemented, but on a

very small scale. This was to ensure that they were not overused, making them arbitrary and less effective. The goal for badges is to motivate a desired behaviour that an organisation would want in their employees. For example, avoiding the printer and saving a conversation on the application as opposed to printing it. Refer to section 4.2.3.8.4 for a list of the badges shown to participants.

While applications with more complex implementations of gamification could use elements such as challenges, missions, levels and the use of “teams”, the researcher decided against this for the prototype. The literature states that gamification elements affect each person differently. The results show there is a fluctuation in response (Interquartile range of 1.5) to the use of gamification in the designed prototype, with 20% of participants strongly agreeing and neither agreeing nor disagreeing that it would increase their motivation. Continuous feedback, provision of long and short-term goals, progressive rewarding, and an unanticipated rewarding mechanism within the prototype has been identified as having a greater impact on the employees.

5.2.2. How motivation for knowledge sharing is affected across teams and within

The answer to this question comes predominately from Activity 1, where interviews with the respondents were conducted. From the initial interviews, we know that there is little team knowledge sharing that occurs. Sixty-five per cent of participants stated they do not approach their colleagues in other teams, and 55% of participants stated that they do not share knowledge with other teams. This could be for reasons such as not knowing what other teams may need, or as mentioned by one participant, not being able to dedicate their time to helping other team members. When asked whether a system to help them bridge the divide between teams in sharing knowledge and storing knowledge, 100% of the participants said yes, with 55% strongly agreeing. Since 75% of participants stated that they enjoy sharing knowledge and they all agreed that they would share knowledge if asked to do so, the researcher felt more confident that the prototype would be something the participants would be interested in and something that they would engage with. This made it easier to approach them with the prototype concept in both phases of development.

When presented with the artefact most participants agreed that they would be more motivated to share their knowledge with colleagues in their team and other teams by using the prototype, as well as being more motivated to make use of other teams’ knowledge. From the results, it is evident that the ability to retrieve knowledge may be improved upon, as the median response was that they neither agreed not disagreed on its effectiveness. However, we know from the literature the difficulty in capturing tacit

knowledge, which is important to obtain in employees in order to change it into organisational knowledge, and thus the difficulty in being able to disseminate it.

The results from Activity 1 also depicts that more than half of the participants (55%) do not share with their colleagues what they have recently learned. This is significantly high when understanding the importance of sharing stories with other employees, and how, in doing so, it may affect knowledge sharing later on. Organisations rely on people working together to seamlessly achieve the goals and objectives, all of which is not possible without good communication. Sharing stories, and what new skills have been learnt, is exceptionally effective at improving workplace communication. It helps to connect colleagues together at a much deeper level. By sharing new skills and personal stories, it enables one to appear more trustworthy and open, allowing others to engage and collaborate more.

On the other end, the majority of the participants (75%) are willing to listen to others talk about their new skills and stories. This means that employees should share more because others are willing to listen, which will improve overall collaboration. The prototype effectively provides a place for more colleagues to open up, share their stories, and be positively received.

Overall, the results from the prototype evaluation regarding motivation to share knowledge across, and within teams, showed that the prototype and its features would effectively work, and positively influence knowledge sharing behaviour, if implemented and instituted within the organisation. With no respondents finding difficulty in accessing team knowledge and being able to collaborate with other team members in promoting organisational knowledge either. Results indicated that when an employee can see the value of their efforts in the knowledge sharing process, they were more likely to continue engaging in knowledge sharing behaviours.

5.2.3. How to develop a prototype of a gamified system for knowledge sharing

The researcher answers this question by applying the knowledge gained from the literature and the initial set of interviews with the employees. This information provided the foundation for the prototype.

During the first set of interviews, whereupon the researcher identifies the problem within the context organisation, A few key requirements for designing a knowledge sharing application became clear. Participants needed uniformity in terms of a knowledge-sharing system. A number of employees stated that they potentially have their own team software (possibly for knowledge sharing). One participant stated they would have to dig through emails, files, and their multiple shared drives to be able to

find what they are looking for. A time-consuming process, if they did not know where to look. This depicts the struggle some employees may face each day in their search for knowledge that already exists within the organisation, but is lost due to the complexity of the systems in place. Therefore, while each team may have their own systems in place, this does not help share knowledge across teams. To have one common system for all employees, it would need to be simple, intuitive and require minimal training. This meant excluding a technical or over-the-top user, keeping the prototype simple, yet effective.

The organisation needed central storage for knowledge where employees from across multiple teams could access. Sixty-five per cent of the participants stated they could currently neither share knowledge nor receive knowledge from other teams. This is significantly high when understanding the importance of sharing knowledge across the organisation. There was also a need to be able to discuss work-related issues on certain topics and the ability to consult these issues at a later point in time. This was to be one focus point in the development of the artefact because team knowledge sharing is an important forecaster of team performance. From this, a Question and Answer (Q&A) section was developed (see 4.2.3.1: Q&A Forum).

In this section, participants can interact and answer questions asked by other employees, in turn sharing what knowledge they have on that topic. All participants agreed on this being an effective way of enabling colleagues to discuss and share each other's work-related knowledge within and across teams.

The lack of an ability to consult colleagues in other teams was brought up in interviews. Sixty-five per cent of the participants stated that they do not approach colleagues in other teams to gain knowledge. While this may relate to the lack of knowledge sharing technology, it could also be that the behaviour to share knowledge goes against human nature, as described in the literature (2.2.2: Knowledge sharing in organisations). It could also be that there is a lack of transparency between teams or an unknown as to what other teams know. One participant stated that they should not only rely on technology but also engage in office discussions, which is a great opportunity for managers to get involved and facilitate such discussions (known as a knowledge café). Through the research, the need for a "WIKI" to be added into the prototype was identified to better improve knowledge sharing (see 4.2.3.2: WIKI Site), especially as one participant referenced a similar feature when describing what their ideal platform was. A WIKI allows each team to create and manage their team WIKI pages, and view other teams' WIKI. This is another place to store knowledge within the system. The main attribute of the WIKI is storing information, and it is known from the

literature that knowledge can be converted from information. All participants stated that it was easier to share and view knowledge, proving the effectiveness of the prototype at storing teams' information, with some participants remarking on how it is a fresh and simple solution.

The literature describes how important employee training is in overcoming knowledge sharing barriers and that for an organisation to grow it needs to provide a learning environment, where employees are encouraged to share knowledge. With this in mind, a learning platform was developed (see 4.2.3.3: Learning Academy). Incorporating a learning platform within a knowledge-sharing system allows for and encourages employees to grow their skills. It allows them to communicate and share their progress with others and to get help when needed. An additional benefit is that it allows organisations to create specific (to their organisation) learning courses. For example, a learning course for new employees, or as one participant suggested during the evaluation phase, a learning course for upskilling new consultants in the products they sell to potential clients.

These three sections, Q&A, WIKI, and the learning academy section, comprised of the core features of the prototype. Another very important aspect of the prototype is how managers can be involved in their employees' knowledge sharing journey. One of the larger problems identified (60% of participants) was that employees felt that management did not encourage and motivate enough for knowledge sharing between teams. To alleviate this problem, the prototype can set personal, intrinsic, goals. These goals are what the employee wishes to achieve (over whatever period they choose). Managers can be involved in this process by providing suggestions on goals they should achieve, based on events such as their performance reviews. Alternatively, employees could show their progress on their set goals for managers to view, providing an additional tool to effective management. Thus, a goal to share knowledge between teams may be set up for employees to try to achieve. By doing this, it also provides a solution to the problem where 50% of employees stated that management does not encourage them to share knowledge. What was unexpected was that 85% of participants do think that management believes in the importance of knowledge sharing. This indicates that the organisation is not completely unaware or ignorant of knowledge sharing, but are simply not able to provide everyone with the correct system. This, in turn, aligns with the research problem discussed in Chapter 1.

In conclusion, to develop a system for knowledge sharing it is important to recognize what the business requirements are, secondly, to understand for whom you are

building the application, and lastly to ensure the application uses tested principles and theories in motivating employees.

5.2.4. The impact the gamified system has on their motivation to share knowledge

By carrying out the evaluation phase of the Design Science Research process, the researcher was able to answer this question. Overall, the participants received the prototype well, with all of the participants highly rating the use of the gamification elements and its positive impact on their motivation to share knowledge. We can deduce that, among other things, gamification works as a motivational tool.

The literature in Chapter 2 describes how not every person works in the same way, nor are they motivated for the same reasons, and thus the system implements features to motivate employees intrinsically. By allowing employees to perform an activity for their own interest or benefit, regardless of what it is, increases their productivity and their work engagement. Ninety per cent of respondents found this feature to be beneficial to them. Proving that if managers allow employees the time, they can become better employees.

The prototype implements operant conditioning (Skinner, 1965) (see 2.3.3: The use of rewards in organisations to motivate people). By using “levelling” and “avatar” gamification element types, operant conditioning is achieved in delaying the timing of when rewards are handed out. Sixty per cent of the participants agreed that the avatar that levels up, unlocking new features, would be engaging. Participants stated that they are familiar with the organisation offering extrinsic rewards for previous events and that they have found it to be motivating, however not all the time. Only 10% of the participants remained neutral towards whether tangible rewards offered by their company would have an impact on their motivation.

The literature also looks at the different user types (Tondello et al., 2016) (see 2.4.5: Player types), which the prototype attempts to cater for in order to try to engage all employees. One such user type is “players”. Players enjoy gamification elements such as Leader boards. The majority of participants remained neutral on their motivation being affected by a leader board. This may not indicate that the leader board is ineffective, but that there are no “player” user types within the organisation. Leader boards may harm employees’ motivation or create a competitive environment, jeopardizing the quality of knowledge shared.

5.3 Research problem

The findings of this study showed that the majority of employees feel that they are given insufficient resources to support knowledge sharing, as well as a lack of technology existing within the organisation to support knowledge sharing properly; this was as expected and aligned with the research problem. While the research problem stated that managers do not put enough emphasis on the importance of knowledge sharing within the organisation, most employees felt the opposite was true regarding their managers. Eighty-five per cent of participants thought that management believed in the benefits of knowledge sharing. However, there were identifiable issues and cause for further study.

With this system in place, managers would be able to monitor their employees' knowledge sharing behaviours and identify patterns which may allow them to modify it depending on how they may interact with the system. This would help adapt the system to the specific organisation. By allowing employees to communicate via the application, it may strengthen the organisations' knowledge sharing culture, the diversity and unique personality traits within the organisation. Currently, 65% of participants stated they do not use or know of, any form of knowledge networks to communicate with other colleagues. The collaborative nature of this system may encourage employees to volunteer their time to assist others. All participants that evaluated the prototype agreed that increased communication between colleagues would encourage them to share their knowledge that they have gained through their work experience, effectively passing knowledge on.

Employees within this organisation would share knowledge if asked to, but if they are not given the right resources, they will not be able to. This can be different in other organisations and would need to be evaluated if applied to another organisation. The prototype effectively allows colleagues to consult with each other in order to gain their intellectual capital, with the majority of participants strongly agreeing to the efficiency of the prototypes ability to search for team knowledge and knowledge on a specific topic compared to any existing system that they have. Participants also agreed that there were sufficient processes and mechanisms for gathering information and knowledge.

5.4 Limitations

The following are the limitations, or shortcomings, identified with this study.

- Due to time constraints and the research design methodology, only a prototype of an application was developed. No actual application, or platform, was developed and implemented in a real-world scenario.

- The final evaluation of the prototype was conducted through interviews with only ten participants as opposed to the initially proposed twenty due to the COVID-19 pandemic that shut down the organisation. However, of the ten participants, all three teams were represented. This is discussed further in the data saturation section below.
- More complex gamification elements such as creating a narrative story were not implemented due to higher levels of complexity, required design skills and time constraints, which could perhaps affect the results.

5.5 Data saturation

As part of the prototype evaluation, the researcher anticipated on completing 20 questionnaires. However, during this period, it became evident that 20 would not be obtainable due to the rising risks COVID 19 would have on the organisation. Therefore, the researcher considered data saturation after each questionnaire.

Data saturation is the point when "no new information or themes are observed in the data" (Guest, Bunce and Johnson, 2006). When data coming in from the questionnaire has little to no variation to the existing data, it signals to researchers that it is safe to stop data collection. Data saturation is often dependent on the research purpose (Faulkner and Trotter, 2017) but there has been numerous research into how many is enough and how to calculate the right number (e.g. Guest, Namey and Chen, 2020).

While the researcher acknowledges that the concept of data saturation is not a good indicator in itself of the quality of qualitative research, the researcher felt it necessary to acknowledge it in this study.

After the tenth questionnaire, no new information was coming in, and the artefact had been evaluated sufficiently. Design Science Research is an iterative process whereby the product is continuously improved until it meets its goal. Therefore, this was expected behaviour.

5.6 Chapter summary

An important finding from this study is that there are various types of employees within an organisation. For example, employees who differ in factors such as age, diversity and personality traits. These varying employee types will be affected by the various implemented gamification elements in different ways. This, in turn, may make certain gamification elements non-essential in motivating them to share knowledge. It may make others more important, and would, therefore, allow the implementer to focus more of their effort in that direction.

A vital feature of a knowledge-sharing application is to create a knowledge-sharing culture within the organisation, with features that focus mainly on promoting and encouraging this type of behaviour. Through the study, an application like this was identified as a clear need within the organisation. While given the limitations, the proposed prototype was one solution that participants accepted. The employees could use it as a tool in their daily activities. A tool that they could use to retrieve knowledge that they may require to effectively do their job, or to store knowledge they may possess for future use or by future employees. In essence, a tool that makes each employee more efficient. A special emphasis has been placed on capturing tacit knowledge, a knowledge type that is more difficult to put online.

Lastly, this study has highlighted the importance of having one system in place for all teams to use as opposed to having multiple internal systems for each individual team. By breaking down the knowledge silos and making knowledge more widely accessible, Organisational growth within its respective competitive market is encouraged, and provides managers with more control in promoting autonomy, mastery, and purpose in the workforce.

CHAPTER SIX: CONCLUSION

6.1 Introduction

The following chapter presents the conclusions, recommendations, and reflection on the study conducted.

Table 8 summarises the identified topics for consideration that should be designed into an Information System to answer various requirements for encouraging knowledge sharing within an organisation.

Table 8: 7 considerations for an effective knowledge sharing system

Topic	**Prototype Feature**	**Benefit**
Knowledge base storing	WIKI	A place where knowledge is stored in different categories for different teams and easily accessible by employees across all teams.
Knowledge sharing collaboration	Question & Answer (Q&A)	A place for employees to come together to discuss and collaborate on specific knowledge topics with their team and others.
Motivation	Gamification	Gamification elements motivate employees to continue using the system and sharing knowledge within their organisation
Intrinsic motivation	Personal goals	Enables a sense of personal desire and understanding into the importance of sharing knowledge.
Extrinsic motivation	Organisational goals and rewards	Provides initial motivation to share knowledge and create trust with managers.
Peer to Peer communication	Chat Feature	Brings employees across teams together (including remote workers) and provides a supportive space for communicating with others. Assists in recording tacit knowledge.
Personal growth	Learning Academy	Increases employees' production value, increases their efficiency and reduces mistakes. Results in more opportunities for employees to share knowledge.

6.2 Summary of the study

Chapter 1 introduces the reader to the importance of knowledge sharing within an organisation. It discusses how knowledge sharing promotes internal learning and consequentially improves the quality of the organisations' product innovations, not to mention the overall work performance of its employees. The research problem identifies how managers fail to place an appropriate amount of emphasis on growing

and establishing proper knowledge sharing between teams. Citing factors such as a lack of time or not understanding what the best approach would be. Employees need to see all organisational knowledge transparently and be able to interact with it. They may become unmotivated to share knowledge if they feel insecure, or uncertain.

The aim of the study was to improve employee motivation by designing a gamified system that encourages employee participation to share knowledge within their team and others.

The first objective was to determine how various gamification elements affect employees' motivation to share knowledge. The researcher met this goal by evaluating the existing literature on gamification elements as well as how they affected motivation.

The second objective was to determine how motivation for knowledge sharing is affected across teams and within teams. This researcher met the goal by conducting initial interviews into identifying problems within the organisation. The researcher was then able to understand the current situation regarding knowledge sharing between teams.

The results from the initial interviews, coupled with the literature gathered, contributed towards achieving the objective on how to develop a prototype of a gamified system for knowledge sharing within an organisation. The initial interviews helped to establish what the key problems were that needed to be addressed and the literature helped provide a concrete grounding on what should be created that would affect motivation to share knowledge. Important outcomes of the literature included personalising a gamified system to the players' behaviours and characteristics as one size does not fit all. It was important to cater for the six user types that Tondello et al. (2016) describes in the Hexad model of gamification user types. This meant adding gamification elements that matched those user types. It was important to incorporate both extrinsic motivation and intrinsic motivation and to understand the difference between tacit and explicit knowledge. The core underlying principle of these gamification elements, as discussed in the literature, was to ensure that the system promoted internal learning without leaning too heavily on rewards provided by the organisation. All of these were key elements in the self-determination theory.

The last objective was to evaluate the effectiveness of the gamified system in motivating knowledge sharing. Participants in three separate teams evaluated the prototype. Introducing this gamified system would positively affect motivation to share knowledge, improving employee motivation to contribute and assist in creating new knowledge for use within their own team and other teams. From evaluating the

prototype, it was indeed clear that every person is unique and would be affected differently by various gamification elements.

By using Design Science Research (DSR) as a framework to conduct the study, it provided focus on the development of an artefact with the intention to improve its performance within the environment. The study produced a prototype that underwent two cycles of development, ensuring that the artefact is rigorously defined and internally consistent.

The main goal of DSR is to produce knowledge, and this study produced sufficient knowledge into gamification, motivation, and knowledge sharing between teams.

6.3 Contribution to knowledge

This study contributes to the knowledge base in two different ways, both compelling in developing gamification and knowledge sharing. The two sections identified were the contributions to theory and the contributions to practice.

6.3.1. Contributions to theory

This study applies and follows a methodology namely “Design Science Research”. This methodology was used as a lens to comprehensively understand and solve the identified problem. The study adds to existing IS literature, further promoting the versatility of gamification in different sectors, and promoting the union of gamification and knowledge sharing.

6.3.2. Contributions to practice

The practical contributions of this study apply to the proposed artefact designed to address the identified lack of motivation, or the lack of any internal system, for knowledge sharing within an organisation across disparate teams.

Practically, this study contributes to the IS discipline, the IS/IT practitioners and organisations with disparate teams. This study will provide these organisations with valuable insight into how to positively affect motivation by applying gamification as a motivational tool within a knowledge-sharing system.

6.4 Recommendations and future research

Based on this study and its findings, the researcher makes the following recommendations and proposals for future research by taking this study and its results into account.

1. Within an organisation, there can be language barriers. Language barriers may exist between teams or within teams. As explained in the literature, it can affect or hamper knowledge sharing that takes places within an organisation. One recommendation would be to look into how to overcome this barrier by using gamification or how to ensure that any language barriers do not have a negative impact on a gamified knowledge sharing system. Future research may also look to measure the effect that language barriers have on employees' motivation to share knowledge, if any.
2. This study selectively chose to exclude teams across international borders. Future research could look into how to use gamification to motivate for knowledge sharing between international teams. Factors to consider would include time zones. If teams are working in time zones that are substantially different and where two teams are not active at the same time, it may pose an additional set of challenges for research.
3. During the design and evaluation of the artefact, a recommendation came up regarding gamification elements. Since there are numerous gamification elements available to utilise, different results could be obtained through using more complex game elements that would require more effort and input to set up. Future research may look at using gamification elements such as Narrative (creating a story) or Missions (predefined sets of challenges) to further motivate employees to share knowledge.
4. Within any organisation, there are employees in different age categories. Future research may evaluate the motivation of how these employees in different age groups are affected by a gamified knowledge sharing system. Different gamification elements may have a varying effect.
5. A recommendation regarding the research method used. By using a different research methodology that includes obtaining qualitative results and analysing may result in different findings.
6. The researcher recommends implementing the artefact as an extension to this study. After creating the application, evaluating it in a real-world scenario may yield different findings.
7. As more employees start working from home, further research may be conducted on how to maintain or improve employee motivation to share knowledge when they are not physically working together. Future research could look at how to utilise gamification in motivating for knowledge sharing across teams and between individuals across the organisation.

6.5 Conclusion

In the final chapter, the researcher concludes this study, highlighting the significant points. By following the chosen research method, the outcome was a prototype of a knowledge-sharing system. This system incorporated gamification as a tool for motivating employees. Top findings of this study included how gamification can be used as a motivational tool; however, some factors may affect the degree of change in motivation. One important characteristic or feature to include when developing a gamified knowledge sharing system is to ensure that there are different types of gamification elements that connect to different “player” types (employees). The literature states that each gamification element may motivate people in different ways, and this was evident from this study. The developed prototype had sufficient gamification so as to be effective for the different types of people within the context organisation. It combined both extrinsic and intrinsic motivation. It would help employees find their internal reason for sharing knowledge, a basic premise of self-determination theory. The system would satisfy their three basic intrinsic needs: competence, relatedness and autonomy. It would build upon the employees’ intrinsic motivation, thus promoting positive behaviour.

By evaluating the artefact, participants of the organisation showed an improved motivation to contribute, create, and store knowledge using the system. Lastly, the study achieved the goal of providing managers with a solution for motivating their employees to share knowledge across teams.

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APPENDICES

APPENDIX A: Ethics Approval Letter

P.O. Box 652 • Cape Town 8000 South Africa •Tel: +27 21 469 1012 • Fax +27 21 469 1002
80 Roeland Street, Vredehoek, Cape Town 8001

Office of the Research Ethics Committee	**Faculty of Informatics and Design**

26 August 2020

This serves to confirm that ethics approval was granted to Mr Matthew Renaud, student number 211009946, for research activities related to the MTech: Information Technology in the Faculty of Informatics and Design, Cape Peninsula University of Technology (CPUT).

Title of dissertation:	Gamification to motivate knowledge sharing between disparate teams

Comments

Research activities are restricted to those detailed in the research proposal.

	**26 August 2020**
Signed: Faculty Research Ethics Committee	**Date**

APPENDIX B: Activity 1 of DSR – Identifying the Problem Questionnaire

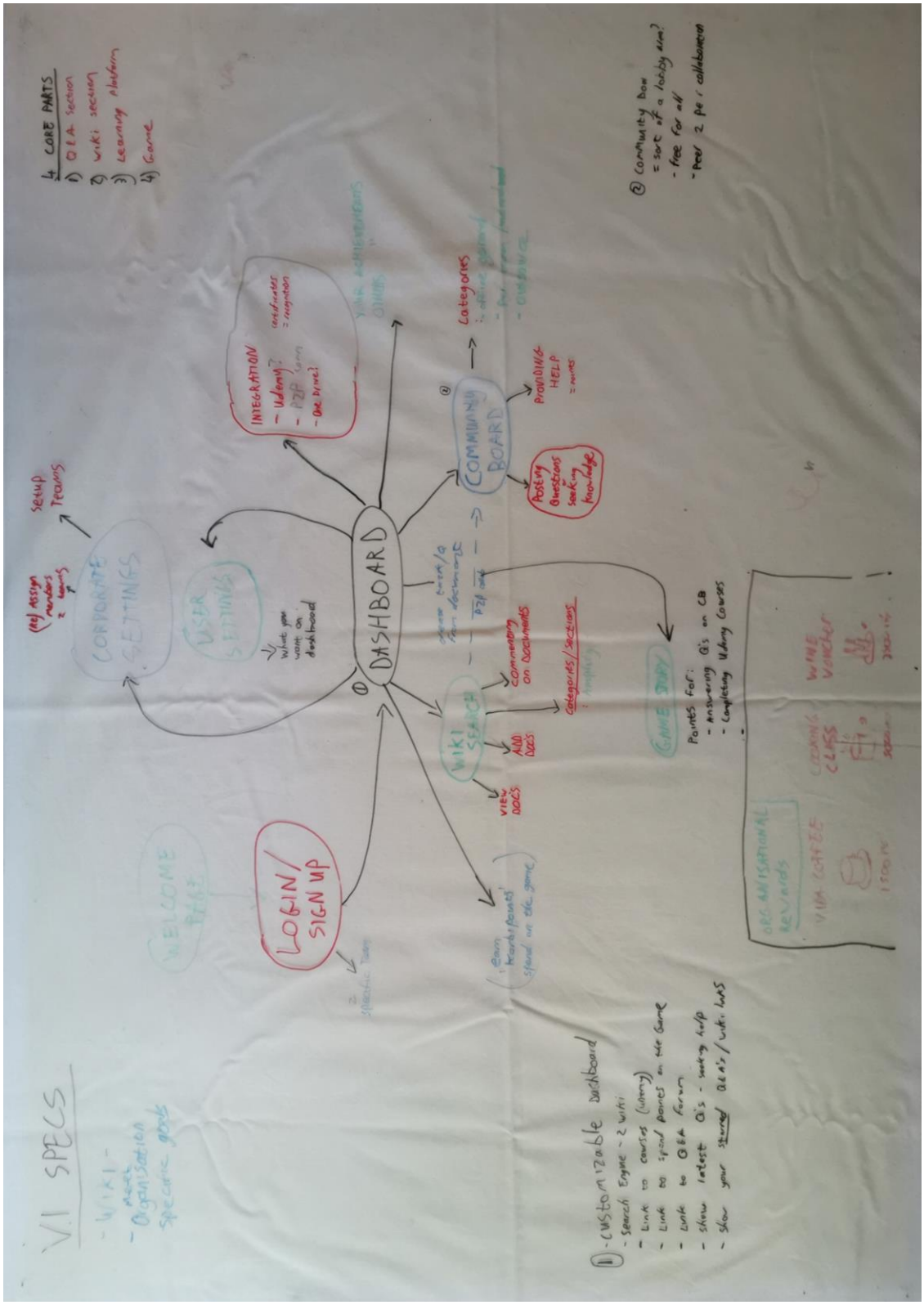
Knowledge sharing: The act of sharing knowledge (Facts, information, and/or skills gained through real world experience) Rate the following statements within the below sections on a scale of: *strongly agree, agree, disagree, and strongly disagree*	
1. KNOWLEDGE COLLECTING	
	I share knowledge I have with colleagues when they ask for it
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I ask my colleagues to teach me techniques they know
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I approach colleagues in other teams to gain knowledge
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	Colleagues share knowledge with me when I ask them to
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I willingly share any new ideas or skills I may have with my colleagues
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I willingly share knowledge with employees in other teams
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I enjoy sharing my knowledge with my colleagues
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	A new system to help share knowledge within and between teams would be beneficial
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
Comments:	

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	Management believes that knowledge sharing is beneficial
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	Management encourages employees to share their knowledge with their colleagues
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree
Comments:	

APPENDIX C: Mind Map of Prototype Design



APPENDIX D: Results from Activity 1 Questionnaire

The following are the results from 20 participants. Each questionnaire consists of four pages.

Welcome to my Knowledge-Sharing Questionnaire

Thank you for agreeing to take part in this important questionnaire as part of my research into knowledge sharing within the organisation. Today I will be gaining your thoughts and opinions in regards to the existence of knowledge sharing within the organisation and its relevance to you.

This survey should only take 5-10 minutes to complete. Be assured that all the answers you provide as part of this questionnaire will remain confidential.

Knowledge sharing: *The act of sharing knowledge between people (Includes facts, information or skills acquired through real world experience).*

Rate the following statements within the below sections on a scale of:
Strongly agree, agree, disagree, and strongly disagree

1. KNOWLEDGE COLLECTING	
	I share knowledge I have with colleagues when they ask for it
	■ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I ask my colleagues to teach me techniques they know
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	I approach colleagues in other teams to gain knowledge
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	Colleagues share knowledge with me when I ask them to
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	■ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share knowledge with employees in other teams
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	I enjoy sharing my knowledge with my colleagues
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	■ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
Comments:	3.2 - GIT doc would ref knowledge points, but not index/ tagged for future reference.

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues
	☐ Strongly agree ☐ Agree ■ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ■ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	■ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

Welcome to my Knowledge-Sharing Questionnaire

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Knowledge sharing: *The act of sharing knowledge between people (Includes facts, information or skills acquired through real world experience).*

Rate the following statements within the below sections on a scale of:
Strongly agree, agree, disagree, and strongly disagree

1. KNOWLEDGE COLLECTING	
	I share knowledge I have with colleagues when they ask for it
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I ask my colleagues to teach me techniques they know
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I approach colleagues in other teams to gain knowledge
	☐ Strongly agree ☐ Agree ☐ Disagree ☑ Strongly disagree
	Colleagues share knowledge with me when I ask them to
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share knowledge with employees in other teams
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I enjoy sharing my knowledge with my colleagues
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

Welcome to my Knowledge-Sharing Questionnaire

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Strongly agree, agree, disagree, and strongly disagree

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	I approach colleagues in other teams to gain knowledge
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	Colleagues share knowledge with me when I ask them to
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share knowledge with employees in other teams
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I enjoy sharing my knowledge with my colleagues
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☐ Agree ☒ Disagree * ☐ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
Comments:	* Can't define immediately

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
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	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	Colleagues share knowledge with me when I ask them to
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	Udemy No time No discussion capacity is a problem KS = better product

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
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Comments:	

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	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
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Comments:	

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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I ask my colleagues to teach me techniques they know
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Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
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Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
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Comments:	

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☒ Agree ☒ Disagree ☐ Strongly disagree
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	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
Comments:	4.5) shouldn't rely on technology only, must involve communicating Management support it, but dont help move it forward / implement it

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Comments:	

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Comments:	2.1 Not unless I ask or there is a forum for it 2.5 Is that more work for me?

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Comments:	3.3 Maybe? Doesn't know 3.4 If I am, Dont know about it

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Comments:	4.1 Not actively mentioned / or discussed Dont discourage it

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Comments:	Sharing between teams are selective. Mostly based on the resources required to complete a specific assigned task.

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	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I ask my colleagues to teach me techniques they know
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I approach colleagues in other teams to gain knowledge
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Colleagues share knowledge with me when I ask them to
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share knowledge with employees in other teams
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	I enjoy sharing my knowledge with my colleagues
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☐ Agree ☒ Disagree ☒ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☐ Agree ☐ Disagree ☒ Strongly disagree
Comments:	ACL operates quite differently to other teams and therefore knowledge sharing can be difficult. But it would be great to have access to other teams' "tips and tricks" for example so that we could find potential similarities / common aspects.

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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Rate the following statements within the below sections on a scale of:
Strongly agree, agree, disagree, and strongly disagree

1. KNOWLEDGE COLLECTING	
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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I ask my colleagues to teach me techniques they know
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
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	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
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	I willingly share any new ideas or skills I may have with my colleagues
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	I enjoy sharing my knowledge with my colleagues
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	* Because we work across teams we need a one platform that is easily accessible and that we can refer back to. Currently we troll through different files on our shared drives and emails.

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ☒ Agree (not one platform though) ☐ Disagree ☐ Strongly disagree
	I use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with other colleagues
	☐ Strongly agree ☐ Agree ☒ Disagree (GP uses sharepoint) ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☒ Agree (but is not effecient/simple to use) ☐ Disagree ☐ Strongly disagree
Comments:	we need a wiki !!! needs to be built.

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams ☐ Strongly agree ☒ Agree (it could be encouraged more ~~and~~ initially could be supported more) ☐ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial ☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues ☐ Strongly agree ☒ Agree (however time should be carved out to do this) ☐ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing ☐ Strongly agree ☐ Agree (its there in some aspects but I think guidance on how to do this should be given to management) ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	a wiki!

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	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help collect knowledge between teams and within my team would be beneficial
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
Comments:	We currently have sharepoint where we can attach documents, but I agree that it's not ~~not~~ the most intuitive. I like sharing knowledge and helping others. Team members within our team assist each other. Knowledge does get lost within the team.

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
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	I willingly share knowledge with employees in other teams
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	I enjoy sharing my knowledge with my colleagues
	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
	A new system to help share knowledge within and between teams would be beneficial
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
Comments:	Not all knowledge will be beneficial to everyone, some teams could not care less what happens in GP (example). We have Amplify which sometimes is also not relevant to all and feels like forced topics to fill the calendar. A repo would be more beneficial and then keep the presentations for when someone wants to show/share something

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
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	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
Comments:	We "share" knowledge with other teams via a shared network folder (which is just Amplify stores). There is no repo. Communicate via Slack with dedicated channels. I can easily share knowledge, but gets lost on sharepoint because people don't use it.

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
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	Management encourages employees to share their knowledge with their colleagues
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree Don't think you need to monitor it
Comments:	We only share knowledge with other teams in our monthly meetings. Management does encourage knowledge sharing - even sometimes set as performance goals. If ~~we~~ we ask for tools like crystal, postman, testlink (just to name some) it is considered and possibly a license purchased so we can be more efficient and share across members. Maybe we currently don't know what we need to best store and catelogue our knowledge?

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Comments:	

2. KNOWLEDGE DONATING	
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Comments:	

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	I am able to share and access knowledge from colleagues in other teams
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Comments:	

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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	A new system to help collect knowledge between teams and within my team would be beneficial
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Comments:	

2. KNOWLEDGE DONATING	
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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
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Comments:	

3. ICT USE	
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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	I am given sufficient resources to support knowledge sharing within the organisation
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	I am able to share and access knowledge from colleagues in other teams
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
Comments:	3.1 Possibly

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues
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	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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	☒ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

2. KNOWLEDGE DONATING	
	When my colleagues have learned something new, they tell me about it
	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
	I willingly share any new ideas or skills I may have with my colleagues
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Comments:	

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
	☐ Strongly agree ☐ Agree ☐ Disagree ☒ Strongly disagree
	In my organisation, employees widely make use of storing technologies (e.g. databases) to access knowledge.
	☐ Strongly agree ☐ Agree ☐ Disagree ☒ Strongly disagree
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	☐ Strongly agree ☐ Agree ☒ Disagree ☐ Strongly disagree
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Comments:	

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	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☐ Strongly agree ☒ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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Comments:	

2. KNOWLEDGE DONATING	
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	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
Comments:	[redacted] "I am reserved" - respondent

3. ICT USE	
	My organisation makes use of technology that allows employees to share knowledge with other persons inside the organisation
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	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☑ Strongly agree "want them to see what we accomplished" ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

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	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
Comments:	little to No Tech! → for such things

4. MANAGEMENT SUPPORT	
	Management encourages and motivates knowledge sharing between teams
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	Management believes that knowledge sharing is beneficial
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	Management encourages employees to share their knowledge with their colleagues
	☐ Strongly agree ☐ Agree ☑ Disagree ☐ Strongly disagree
	Management provides the needed help and resources to enable knowledge sharing
	☐ Strongly agree ☑ Agree ☐ Disagree ☐ Strongly disagree
	A system where managers can monitor knowledge sharing within the organisation would be beneficial
	☑ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree
Comments:	

APPENDIX E: Activity 5 – Evaluating the Prototype Questionnaire

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	4	5
How efficiently can you retrieve knowledge from another team using the prototype?	1	2	3	4	5
Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?	1	2	3	4	5
Are you more likely to share knowledge on the system for members of other teams to view?	1	2	3	4	5
Does the system make it easy to access and view other teams' work-related knowledge?	1	2	3	4	5
Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?	1	2	3	4	5
MOTIVATION TO SHARE KNOWLEDGE:					
Will your motivation be affected by moving either up or down on a leaderboard?	1	2	3	4	5
Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	1	2	3	4	5
How engaging do you find the use of the avatar to level up and unlock new features of the system?	1	2	3	4	5
Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	3	4	5
Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	4	5

KNOWLEDGE COLLECTING:					
How efficiently can you retrieve knowledge for a specific topic?	1	2	3	4	5
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	4	5
Within the system are there sufficient processes and mechanisms for gathering information and knowledge?	1	2	3	4	5
How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	1	2	3	4	5
Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	4	5
KNOWLEDGE DONATING:					
How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	4	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	4	5
Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	1	2	3	4	5
Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	3	4	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	4	5
GENERAL COMMENTS:					

APPENDIX F: Results from Activity 5 Questionnaire

The following are the results from 10 participants. Each questionnaire consists of two pages.

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	(4)	5
How efficiently can you retrieve knowledge from another team using the prototype?	1	2	3	4	(5)
Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?	1	2	3	4	(5)
Are you more likely to share knowledge on the system for members of other teams to view?	1	2	3	(4)	5
Does the system make it easy to access and view other teams' work-related knowledge?	1	2	3	(4)	5
Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?	1	2	3	(4)	5
MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	(3)	4	5
Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	1	2	(3)	4	5
How engaging do you find the use of the avatar to level up and unlock new features of the system?	1	2	3	(4)	5
Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	(3)	4	5
Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	(4)	5

KNOWLEDGE COLLECTING:

How efficiently can you retrieve knowledge for a specific topic?	1	2	3	4	(5)
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	4	(5)
Within the system are there sufficient processes and mechanisms for gathering information and knowledge?	1	2	3	(4)	5
How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	1	2	3	(4)	5
Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	4	(5)

KNOWLEDGE DONATING:

How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	(4)	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	(4)	5
Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	1	2	3	(4)	5
Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	3	(4)	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	(4)	5

GENERAL COMMENTS:

Gamification - Ability to enable/disable setting but and always keep points gathering. (merely hides it)

Chat - Direct Msg team tag (see people from particular teams at a glance)

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	(4)	5
How efficiently can you retrieve knowledge from another team using the prototype?	1	2	3	(4)	5
Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?	1	2	3	(4)	5
Are you more likely to share knowledge on the system for members of other teams to view?	1	2	3	(4)	5
Does the system make it easy to access and view other teams' work-related knowledge?	1	2	3	(4)	5
Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?	1	2	3	(4)	5
MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	(3)	4	5
Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	1	2	3	(4)	5
How engaging do you find the use of the avatar to level up and unlock new features of the system?	1	2	(3)	4	5
Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	(3)	4	5
Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	(4)	5

KNOWLEDGE COLLECTING:					
How efficiently can you retrieve knowledge for a specific topic?	1	2	3	(4)	5
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	(4)	5
Within the system are there sufficient processes and mechanisms for gathering information and knowledge?	1	2	3	(4)	5
How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	1	2	3	(4)	5
Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	(4)	5
KNOWLEDGE DONATING:					
How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	(4)	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	(4)	5
Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	1	2	3	(4)	5
Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	3	(4)	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	(4)	5

GENERAL COMMENTS:

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

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KNOWLEDGE COLLECTING:

How efficiently can you retrieve knowledge for a specific topic?	1	2	3	4	5
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Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	4	5

KNOWLEDGE DONATING:

How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	4	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	4	5
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Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	4	5

GENERAL COMMENTS:

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

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MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	3	4	5
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Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	4	5

KNOWLEDGE COLLECTING: How efficiently can you retrieve knowledge for a specific topic?	1	2	(3)	4	5
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	4	(5)
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KNOWLEDGE DONATING: How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	4	(5)
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Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	(3)	4	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	4	(5)

GENERAL COMMENTS:

Late !!

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	3	(4)	5
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Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	4	(5)

GENERAL COMMENTS:

an improvement! some useful features!

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	(4)	5
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MOTIVATION TO SHARE KNOWLEDGE:					
Will your motivation be affected by moving either up or down on a leaderboard?	1	2	3	(4)	5
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Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	3	4	(5)
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KNOWLEDGE COLLECTING:					
How efficiently can you retrieve knowledge for a specific topic?	1	2	(3)	4	5
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How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	(4)	5
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Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	(4)	5

GENERAL COMMENTS:

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	(4)	5
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MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	(3)	4	5
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How efficiently can you retrieve knowledge for a specific topic?	1	2	(3)	4	5
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KNOWLEDGE DONATING:					
How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	4	(5)
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Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	(3)	4	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	(3)	4	5

GENERAL COMMENTS:

Familiar with company giving rewards out. Doesn't always work? But can work

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	4	(5)
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Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	(4)	5

3 → 4

KNOWLEDGE DONATING:

How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	(3)	(4)	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	(3)	4	5
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Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	(3)	4	5

GENERAL COMMENTS:

One Course Idea: upskilling new consultants on what we sell to (potential) clients

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	4	(5)
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MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	(3)	4	5
Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	1	2	3	4	(5)
How engaging do you find the use of the avatar to level up and unlock new features of the system?	1	2	(3)	4	5
Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	3	4	(5)
Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	(4)	5

KNOWLEDGE COLLECTING:					
How efficiently can you retrieve knowledge for a specific topic?	1	2	3	(4)	5
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	(4)	5
Within the system are there sufficient processes and mechanisms for gathering information and knowledge?	1	2	3	(4)	5
How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	1	2	3	4	(5)
Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	(4)	5
KNOWLEDGE DONATING:					
How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	(3)	4	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	(4)	5
Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	1	2	3	(4)	5
Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	3	4	(5)
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	(4)	5

GENERAL COMMENTS:

Knowledge Sharing Prototype

For each of the questions below, circle the response that best characterizes how you feel about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4= Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
TEAM KNOWLEDGE SHARING:					
How effective is the prototype at storing your teams' information and collective knowledge?	1	2	3	4	(5)
How efficiently can you retrieve knowledge from another team using the prototype?	1	2	(3)	4	5
Does this system make it easier to collaborate with members of your team and of other teams to produce a knowledge base for everyone to use?	1	2	3	(4)	5
Are you more likely to share knowledge on the system for members of other teams to view?	1	2	3	(4)	5
Does the system make it easy to access and view other teams' work-related knowledge?	1	2	3	4	(5)
Does the usability of the prototype and accessibility of knowledge encourage you to make use of other teams' knowledge?	1	2	3	4	(5)
MOTIVATION TO SHARE KNOWLEDGE: Will your motivation be affected by moving either up or down on a leaderboard?	1	2	(3)	4	5
Would you be encouraged to share and contribute knowledge more if the company offered a tangible reward?	1	2	3	4	(5)
How engaging do you find the use of the avatar to level up and unlock new features of the system?	1	2	(3)	4	5
Will the game elements (badges, leaderboard, points, intrinsic goal setting) motivate you to contribute and use the system for knowledge sharing?	1	2	(3)	4	5
Would you find benefit in the personal goal-setting feature and its associated rewards?	1	2	3	(4)	5

KNOWLEDGE COLLECTING: How efficiently can you retrieve knowledge for a specific topic?	1	2	3	(4)	5
How efficient is the prototypes' ability to search for team knowledge compared to any existing system currently in place?	1	2	3	(4)	5
Within the system are there sufficient processes and mechanisms for gathering information and knowledge?	1	2	3	(4)	5
How effective is the system at allowing colleagues to consult with each other in order to gain their intellectual capital?	1	2	(3)	4	5
Do you think the system will persuade users to share their knowledge more, and, in turn, allow you to receive knowledge more often?	1	2	3	4	(5)
KNOWLEDGE DONATING: How effective is the prototype at enabling colleagues to discuss and share each others' work-related knowledge?	1	2	3	(4)	5
How effective is the prototype at encouraging communication between members of the same team and across other teams?	1	2	3	(4)	5
Does the prototypes' chat feature assist you with receiving and sharing knowledge within your team?	1	2	3	4	(5)
Will increased communication between colleagues encourage you to share your knowledge gained through work experience?	1	2	3	(4)	5
Does the usability and the collaborative nature of the system encourage you to volunteer your time to assist your colleagues?	1	2	3	(4)	5

GENERAL COMMENTS:

Participant stated: "fresh take on storing team knowledge"