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Gamification and Occupational Safety and Health Training:

Possibilities for Development in the Latvian Context

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Thesis
December 2020
Master's degree in Education
Entrepreneurship
Oulu University of Applied Sciences

ABSTRACT

Oulu University of Applied Sciences
Master's degree in Education Entrepreneurship

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Title of Master´s thesis: Gamification and Occupational Safety and Health Training: Possibilities for Development in the Latvian Context
Supervisor: Blair Stevenson
Term and year of completion: December 2020 Number of pages: 99 + 16

Latvian Occupational Safety and Health (OSH) industry is currently facing a knowledge gap. Outdated statutory safety laws remained in effect for years and that has a consequential effect on OSH training system and on the mindset of the workers who are exposed to hazardous work conditions. It is well-established that modernization of the training system coupled with gamified learning has helped substantially to reduce workplace injuries and improve productivity.

This study aims to identify two key sets of factors, firstly the OSH factors that are in focus in the existing training system and secondly, the factors that have potential to influence the existing system to adopt gamification as a learning platform. Specifically speaking, this study investigates into the existing Latvian OSH training ecosystem to evaluate the training methods and its impact on both trainers and workers. Subsequently, it delves into the theoretical aspects of gamification and assesses about how meaningfully gamification can contribute to the Latvian OSH training system.

To better understand the compatibility between the contexture of the existing OSH training system and that of gamified learning, an online survey was distributed to both OSH specialists and workers, and a basic gamification-based training framework was conceptualized which could use the data collected from the survey and conceptualize the design of an updated learning environment. Respondents were randomly divided into two segments (small group of OSH specialists and larger group of workers) and asked to respond to a carefully devised questionnaire. Responses were segmentized for the purpose of both quantitative and qualitative analysis. The results showed an overwhelming number of respondents favoring an upgrade of the existing training system and openness to adopt a gamified learning system.

The outcome of this thesis results suggest that Latvian OSH training system needs an upgrade and gamification may have a significant contribution to modernize it and enhance its functionalities. On this basis, the outcome of this thesis can be meaningfully used to lessen the lead time to design a gamification model, in Latvian context.

Keywords: Occupational Safety and Health, Gamification, training

CONTENTS

1 INTRODUCTION

First documented in 1891 in Milwaukee, USA by Schuster's Department Store as retail loyalty stamp for reward redemption, the modern concept of gamification evolved in terms of concepts and technical advancements to eventually introduce itself as a key learning tool in various fields of education.

Around the same time, the second industrial revolution in the USA, fuelled by technological invention especially in sectors like infra, oil and gas led the focus on two important aspects – A. replacing legacy machineries with more modern, more efficient machines, and B. Higher level of operating knowledge among the workers to ensure optimized productivity with minimum injury.

Subsequently, at the onset of the third Industrial revolution in the 1970s, technology trends witnessed a tectonic shift in favour of digitization and computer/microprocessor driven precision machinery some of which included applications of next-generation technical innovations around robotics and artificial intelligence as well. This saw a surging demand to rearm the workforce with operational knowledge of the newer technologies.

Such a process of modernization and upgrade of the production process brought along the obvious impetus on workers training programs that are innovative, effective, agile, and scalable.

According to a year 2005 estimate of International Labour Organization (ILO), every year over 2.3 million women and men died at work from occupational injury or resulting diseases (ILO, 2015, p.1). Over 350,000 deaths were reported annually, which were caused by fatal accidents. Almost 2 million deaths occurred due to work-related health hazards. In addition, over 313 million workers were victim of non-fatal occupational accidents that caused serious injuries and resulted in loss of man-hours. The ILO further estimated the worldwide number of non-fatal work-related diseases to approximately 160 million per annum. What these estimates point to is something extremely grave, i.e., approximately 6,400 deaths from occupational accidents or diseases and roughly 860,000 workplace injuries are occurring every single day.

This continuous occurrences of injury and death warranted a closer examination of preventive methods that were adopted and already in use. This situation also calls for innovative, imaginative, novel, or upgraded solutions that are scalable, flexible, and adaptable for both the employers and the workers. To elaborate on what has been mentioned earlier, the past decades have witnessed rapid globalization and an ever-accelerating pace of industrialization which resulted into technological, social and organizational changes in workplaces accompanied with the emergence of risk factors in newer forms:

- New job responsibilities that lead to exposure risks relating to work intensification, work hours rearrangements, the fragmentation of production processes, and organizational restructuring;
- Emerging nature of employment, including temporary/contractual assignments, part-time duties and Work from Home arrangements;
- Stress factors like employment insecurity, disproportionately high job expectations, and vulnerable and perilous nature of employment that have fast become popular with employers with the onset of uncertainty and volatility due to financial crisis and recession;
- Demographic and socio-political changes due to migration, the ageing factor, lack of access to sustainable employment among young workers, and a boom in employment in non-formal sectors;
  and
- Global geo-political crisis, aggravated by the economic recession, with pandemic factor threatening to impact larger segments of the working class in years to come.

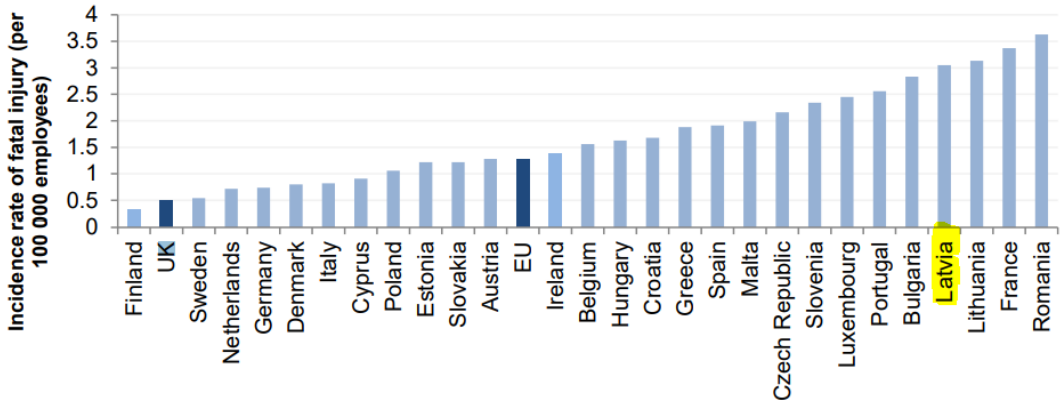
In most countries, various forms of Occupational Safety and Health (OSH) training are now made mandatory by government regulations and this is now viewed as an essential activity within any company. The scope and intensity may vary but it has been made mandatory across industrialized nations like France, Germany, Canada, and the USA (ILO, cited 19.11.2020).

By analysing the features of work-related fatalities, and non-fatal occupational injuries and diseases in the Latvian context, it can be understood about how critical it is to define priorities and design effective preventive strategies, in OSH.

Data on accidents at work

The figure below shows data from 2015 pertaining to fatal workplace injuries in Europe. Latvia, in comparison with other EU countries, finds itself in the bottom 15%.

Figure 1. Standardized incidence rates (per 1000,000 employees) of fatal injury at work, excluding road traffic accidents and accidents on board transport in the course of work for 2015 (Eurostat, ESAW, 2015)



The recent rise in number of incidents is worrisome, given that the factors like academic studies and hazard awareness could be addressed relatively easily thanks to the country's small population. This rise has several contributing factors, the most defining of which is the work culture of workers exposed to hazardous work conditions.

The table below displays how the pattern of occupational accidents at work in Latvia has changed over the last 5 years. Given the small population of 2 million, these numbers are alarmingly high.

Table 1. The dynamics of the accidents at work 2015-2018 (VDI, 2018)

	2018	**2017**	**2016**	**2015**
Total (fatal, serious and minor)	2 191	1 916	1 854	1 727
Fatal	30	21	38	26
Serious	209	206	184	166

According to the information available from Latvian Labour Inspectorate, 2191 number of employees suffered from accidents at work in Latvia in 2018, and 30 of the workplace accidents

were fatal. Compared to 2017, the rate of recorded accidents at workplace had increased by 14.4% in 2018. As can be seen, five years previous to the year 2015, the overall number of victims of workplace accidents had gradually increased steadily but by a slower overall rate of 26,87% (see Table 1.)

It is important to mention, that the numbers mentioned above are based on reported incidents. Estimates of unreported incidents point to the fact that this number would be much higher. This understanding comes from the data in the report "Severe Under-reporting of Work Injuries in Many Countries of the Baltic Sea Region: An exploratory semi-quantitative study" by the Finnish Institute of Occupational Health (Kurppa, 2015). In the issue of work safety, the most important element is the worker, who in case of accident is often found to be playing triple role: the decision maker, the initiator of an accident and the injured person or, in the worst case, the casualty. Workers themselves are the major contributors to hazards that result in accidents of different degree (Ayeni, 2011). For example, in 2018, Latvian OSH domain witnessed 69% of the accidents occurring due to human errors, out of which 30.7% proved to be fatal while 38.3% received serious injuries (VDI, 2018, p. 13).

One of the key challenges here is to protect workers from injuries resulting from lack of knowledge and awareness. A solution for that requires an initial inspection of the relevance of safety and quality training provided, and whether the training module was outdated or the training was of inferior quality or the combination of any of these. Subsequently, measures should be taken to ensure the effective execution of instructions, and proper training in safe work practices. In some cases, changes to the nature of training aids are required, for example, addition of video and audio content, the creation of visual diagrams and models; or a more effective use of modern training technologies and testing of knowledge of labour protection requirements can be used after calibrating the worker/s' skillset. For all employees, including heads of organizations, as well as employers and individual entrepreneurs, there should be training in the fields of labour protection and testing of knowledge of labour protection (Zilberman, 2019).

Work culture, including adherence to hazard protocols and preventive measures, significantly influences the attitude and approach toward work hazards. This also influences about how prevention measures are accepted and adopted. It is imperative to define the term 'work culture' before we understand the correlation between this phenomenon and the number of accidents.

Further, definitions and observations on work culture can help understand its prime attributes and its relationship dynamics with the OSH workers.

For the purposes of this study, workplace culture is defined as:
“the shared values, belief systems, attitudes and the set of assumptions that people in a workplace share. This is shaped by individual upbringing, social and cultural context.” (Agarwal, 2018, p.1) In other words, it is the culture around a workplace which provides a comprehensive framework for understanding the different facets of work behaviour (Sinha, 1991). The notion of work culture is that of the human environment within which an organization’s employees perform their jobs (Pattanayak, 1998).

The suggestion that gamification can possibly support more effective OSH training and improve the work culture comes from the lack of the training modules in producing desired results. For example, web-based training programs that educate workers from the manufacturing sector on safety aspects primarily through lecture videos, largely fail to have significant effect in improving work culture, and reduce workplace incidents (Abdalla, 2017, Glass, 2017). It has been suggested that by remodelling training, OSH training consultants could develop more engaging, behavioural model training to improve the safety performances (Burke et al., 2006). There are many potential tools that could be used to accomplish this, and gamification has become an increasingly more frequent choice in the redesign of traditional training options (Armstrong, 2018).

In 2015, the *Safety Matters* program by *EnTrans* was considered successful to help workers develop "framework, tools, training and technology that empowers them to change how they work." (Czor, 2019, p. 61). This program “incorporated game-like elements to engage employees to take ownership of their personal safety and that of their colleagues. Those elements include a point system, monthly and annual rewards and visual aids.” “The company provides safety training in a number of languages and delivery methods. The blended-learning training program includes web-based and instructor-led training, videos and BYO L&L (Bring Your Own Lunch & Learn) webinars for managers, safety leaders and supervisors” (Czor, 2019, p. 62)

Notably, the company has seen a remarkable improvement in employee engagement across all departments of the organization since the introduction of the Safety Matters program. Even though gaming elements in the Safety Matters program cannot be detached from the rest of the modules

and independently evaluated, it is suggested that key game-elements, such as points, greatly support the training progress. According to Karen Czor, Corporate Director of Risk Management in EnTrans International LLC, “when Safety Matters was first introduced, our facilities were barely earning more than 26 out of 36 points in the program... [In 2019], most locations average between 30-34 points per month”.

This example is not the only case of gamification in OSH trainings. Nevertheless, it’s a good example that’s elaborated further in chapter 5.

In this work, the focus is placed on gamification in an attempt to demonstrate its potential contribution in OSH trainings and its possible benefits to both employees and the organisation. To be specific, responses of adult learners towards gamified learning in a corporate environment will be studied at different levels. This thesis presents data and analyses those to present a conceivable model that adequately addresses the Occupational Safety and Health training-related requirements in Latvian context. This will help to assess the level of modernisation and digitisation that Latvia needs to ensure a higher standard of workplace safety.

The captured data would be curated to explore the possibility of acceptance of gamification by the industry workers who are exposed to potential OSH hazards.

The research questions of the study are:

1. *What are the factors influencing OSH training in Latvia from the perspective of trainers and workers?*
2. *How can Gamification influence OSH training scenario in Latvia?*

Additionally, there is a need for guidance to implementation of new programmes, assess and improvement of existing programmes in Latvia (Cabinet of Ministers, 2016). For this purpose, one of the objectives of this work is to create a framework that will help to engage stakeholders in sustainable design, implementation, and evaluation of distributed training initiatives.

The framework will incorporate the use of gamification in OSH trainings along with other teaching methods and tools, based on the findings and results of this study.

2 THEORETICAL BACKGROUND

The UNESCO report titled *Education for the 21st Century Committee (Delors, 1996)* talks about an ideal education system where knowledge, aided by scientific learning and contextualized education, serves the immediate goal of self-reliance and the greater goal of connected coexistence. Technical education is seen as a tool that prepares the student to live in society, contributes to amplifying the essential elements of apprenticeship, and empowers the student in applying these contents into day-to-day knowledge. To do so, education system should stay dynamic and agile in terms of adoptability to assimilate new ideas in all forms of learning. It should also be able to seamlessly connect itself to changes on both knowledge and technology fronts. This should happen without compromising the bases of fundamental knowledge, social ethics and principles.

The European Union's Recommendation on *Key Competences for Lifelong Learning* was originally produced in the year 2006 and was updated in the year 2018. This document focuses on the need for periodic upgrade of education and training systems and sets guideline for such upgradation. This report extends its recommendation to emphasise on the interconnectivity of key elements like education, training and employment under the purview of formal, non-formal and informal learning (*The council of the European Union, 2018*).

The need to develop new strategies and solutions and to apply both for well-known hazards and risks[1] as well as for emerging issues such as biological hazards, psychosocial hazards and musculo-skeletal disorders was articulated during the 2003 International Labour Conference. It was recommended that practical and easy-to-use training materials would be developed and newer methods focussing on the "train-the trainer" approach on key aspects of safety and health would be explored (*ILO, 2004*).

Distance learning has been a topic of discussion from late 1990s (*Keegan, 2013, p. 4*). Distance learning, alternatively referred to as "e-learning" or "online learning" is progressing due to the development of technology.

[1] *such as those arising from dangerous substances, machinery and tools and manual handling*

With the growing demand for interactive online education, companies are looking to upgrade current training solutions. According to *Gamification by Design* co-author Gabe Zichermann, "gamification is 75 percent psychology and 25 percent technology" (*Carr, 2011*) There are many advantages for companies to introduce gamification technologies (*Gartner, 2012, Zichermann, 2013, Petridis et al., 2014)* related to collecting users' data, visualizing achievements and progress, (*Gutierezz, 2020*), and increasing involvement (*Singh, 2012*).

3 EDUCATIONAL AND LEARNING PSYCHOLOGY

At the core of learning lies human intelligence which applies itself at every stage of data management in life, the foremost of which being learning. Learning psychology is very widely studied and researched subject. Study of the models of learning psychology gives us key ideas about how information is acquired, absorbed, processed, classified and later constructed together to contribute to a meaningful learning mechanism (Isaev & Slobodchikov, 2013).

Among the first and the most notable of the educationists, Aristotle had a refreshingly different understanding of how learning could be imparted. Among many methods that he adopted, one was to divide learning into three prime categories: theoretical, practical and technical. He said “anything that we have to learn to do we learn by the actual doing of it… We become just by doing just acts, temperate by doing temperate ones, brave by doing brave ones” (Aristotle Nicomachean Ethics, Book II, 1976, 91 as cited in Salem & Timmerman, 2017, 208). Such an approach of learning always finds the components of reasoning reinforcing it in every step by rationalizing the learning, Aristotle’s observation lays the baseline for understanding information acquisition and validation.

More recent systems of education are multilayered, individualistic and expand their scopes organically within the ecosystem of the specialized fields of study. Psychologists working in the field of specialized education are concentrating their efforts in inventing or identifying knowledge input methods to help students comprehend and consume information from external sources in order to feed the process of continuous evolvement.

Educational Psychology and consists of two words Psychology and Education. While General Psychology is a pure science. Educational Psychology is its application in the field of education with the aim of socializing man and modifying his behavior. Educational psychology is one of the branches of applies psychology concerned with the application of the principles, techniques and other resource of psychology to the solution of the problems confronting the teacher attempting to direct the growth of children toward defined objectives.

Learning is lifelong process and humans learn from every possible source, consciously or without his/her knowledge. Thus, structured, documented, rated learning processes are not the only

credible sources of learning. The informal routes of acquiring knowledge have their due importance in life, as well. Educationists working in the subfield of informal and vocational learning closely examine the human approach to learning in a variety of social and environmental settings to identify approaches and strategies that can make learning more effective.

In informal/vocational studies/trainings diversity of learners in the study group always poses challenges for the educators. Factors like lack of homogeneousness among learners in terms of academic background, learners' academic qualification/specialisation, and educators' unfamiliarity with the target audience make it challenging to keep informative communication of different degree of importance equally attractive. Educational psychologists tend to use a wide spectrum of theories to explain brains' development and to get to the realm of individual learning process to bridge the gap.

Major Perspectives in Educational Psychology

With technological advancements, came new theories, including Neil Fleming's VAK (Visual, Auditory, Kinaesthetic) model that explained the sensory modalities in a much machine-interpretable way.

"As happens with other fields of studies using theory oriented analytical psychology, educational psychology is hugely researched and experimented domain of work with numerous contributions from established educationists around the world. However, the perspectives of noteworthy and adoptable research works, dissertations, meta-analysis have been limited to three distinct categories" (Writers, 2020).

The behavioural perspective - this suggests that all behaviours are essentially the outcome of mental conditioning. The operating condition, irrespective of the work or living environment, directly contributes to behavioural changes in humans. For example, a supermarket might hand out festive coupons or has a points-based system to redeem for prizes or discount in a foreseeable future to reward loyal behaviour of the customers. This approach, however, is seen meeting limited success as this is largely a passive persuasion, lacks inherent motivation that usually comes with an progressive process of self-learning, and often faces psychosocial hurdles like attitude, peer pressure to alter choice, and a lack of constant automated persuasion.

The developmental perspective largely based on the evolvement of human brain and its capability to increasingly acquire skills, develop knowledge and reasoning. This perspective finds its relevance in cases where children use their evolving capability to analyse and rationalize patterns in order to develop an understanding for things as they grow. Jean Piaget's theory substantiates an important developmental theory looking at how children grow intellectually and adopt the process of learning that gets better, and self-reliant with age. This perspective facilitated an insight into children's mental development at different growth phases. As this perspective takes out the considerations of individualistic mental developments, this provides educators a broader set of data to develop instructional methods and design learning material for different age groups.

The cognitive perspective Anthony Gregorc and Kathleen Butler (1984) published a model which postulated that an individual's perceptual abilities lay the platform of his specific strengths and patterns of learning. This led to, probably, the most relevant context of learning in the era when technology opened doors of possibilities like never before. This is the concept of Cognition.
It has become much more widespread in recent decades, mainly because it accounts for how things such as memories, beliefs, emotions, and motivations contribute to the learning process. Cognitive psychology focuses on understanding how people think, learn, remember, and process information. Educational psychologists who take a cognitive perspective are interested in understanding how kids become motivated to learn, how they remember the things that they learn, and how they solve problems, among other things.

The overall process of Cognition should be understood in the contexts of *Cognitive process* and *Cognitive Skills*. Cognitive processes contribute to the making of Cognitive skills. And Cognitive skills are something that the author will be exploring to explain and justify different methods and approaches that are adopted to analyse the qualitative data.

Cognitive processes are largely parallel in nature and brain does a process multiplexing to attain the desired objective. The primary processes are triggered by inputs from external sources and remaining of them are secondary processes that originate largely during synthesis of the data that are collected from the same external sources.

Cognitive Skills are the direct outcome of the operations set by Cognitive process.

The primary or Level 1 skillset is:

- Memory;
- Association;
- Concept Formation;
- Pattern Recognition;
- Language;
- Attention;
- Perception;
- Action;
- Problem Solving;
- Mental imagery.

These, in turn, contribute to the close-loop advanced skill build-up including:

- Sustained Attention;
- Response Inhibition;
- Speed of Information Processing;
- Cognition Flexibility and Control;
- Multiple Simultaneous Attention;
- Working memory;
- Category Formation;
- Pattern Recognition.

To understand the application of Cognitive Process into Occupational Safety and Health (OSH) trainings we need to differentiate it from general forms of trainings and see it as a precision, specialized training. To understand this, one will have to start with a target segment, which in the case of OSH trainings in Latvia are adults. In order to plan a training session for such adults, the pattern and extent of their cognition skill was first identified. The author thus adopted *andragogy* as a key conceptual framework for this study. Adult education includes "all activities intentionally designed for the purpose of bringing about learning among those whose age, social roles, or self-perception define them as adults" (Merriam & Brockett, 2007, p. 8). Ultimately, this study will consider informal adult learning as the subdomain of learning and will try to establish some advanced Cognitive skills as the key component for such informal learning skill.

Adult learning, as empirical data suggests, is invariably what the Corporate Education is all about. Though training is a part of education and not the vice versa, both invariably share some of the common Cognition skills.

By the second stage of this work, it is imperative to understand the greater work environment of those who need training. The author thus induced the term of corporate education to establish the context. “Organizations that value employee’s learning can expect to be more competitive in the marketplace” (Vatcharasirisook, 2011, p. 3). Referring to this thesis, the author reviewed the application of andragogical principles to corporate training. Within corporate training, there are different kinds of OSH trainings connected to compliance training, which effect the motivation and engagement of the learners.

Rapid technological advancements have allowed greater possibilities for the education sector to develop and validate novel methods of learning within a reasonably shorter frame of time. In the twenty-first century corporate sector, online education has become commonplace. The diverse range of education technologies that are available today have stimulated the rise of different training modules. With rapid industrialization fuelled by the advent of technology, the argument in favor of personalized learning system is more compelling than ever. The reason behind the growing demand for a personalized learning system is the obvious faster attainment of learning goals. Efficacy of distance learning is greatly enhanced by the adoption of the concept of personalization.

In this work, a focus is also placed on gamification in an attempt to demonstrate its contribution to OSH trainings and it’s benefits to both employee and organisation.

Gamification in corporate training

Gamification itself can be implemented offline and online, but within this work domain, the author will make an emphasis on digital gamification.

The guiding principles of case-based teaching in learning psychology can be used in the training of Occupational Safety and Health awareness, accident prevention and corrective measures. The content of adult learning should be self-reliant to sync with the learning strategies, and intelligent enough to overcome the typical barriers of informal learning. To address this, Aristotle’s original idea of Theoretical, practical and Technical education can be used to structure our understanding.

3.1 Adult Learning

As per EU's youth strategy, the young adults are those who fall within the age bracket of 15-29. The people from above this age group are the target subjects of this study. However, the Employment rate of Latvia (ref. Central Statistical Bureau of Latvia, 2019) shows that the most employed age group is the people from 35 - 44 years.

In order to understand how to teach this segment of adults, it needs to be understood how adult learn. The term "andragogy" was first introduced into scientific circulation in 1833 by the German historian A. Kapp. Adult learning theories are not just a collection of terms, concepts, and ideas about how adults learn. These theories outline how to build the learning process at all its stages - from creating a concept to implementation.

In the first half of the 20st century, the humanistic philosophy had a great influence on andragogy. Rogers (1951) wrote five postulates of the humanistic model of adult education:

1. We cannot educate another person. We can only help him learn.
2. A person successfully learns only when he realizes what is being studied, as directly related to the improvement and maintenance of his self.
3. The experience assimilated by the student can lead to distortion in the organization of the personality and tends to be distorted through symbolization.
4. The personality structure becomes more rigid in the face of a threat.
5. The training situation should minimize threats and facilitate the perception of the subject.

In 1970, Knowles, in his book "The Modern Practice of Adult Education. Andragogy against pedagogy" further highlighted new provisions of the theory of adult education:

1. the leading role in learning belongs to the learning adult;
2. striving for self-realization, the student pursues certain goals, the achievement of which is the result of training;
3. life experience and professional skills of the student should be involved in the educational process;
4. an adult should be able to put the acquired knowledge into practice;
5. Learning is a process of joint activity between a teacher and a student.

Education, according to modern andragogy, should be structured in such a way as to minimize the role of the teacher, who, although managing this process, is less likely to use didactic techniques. “Adult education textbooks often proclaim that adult learning is self-directed, the ability to self-initiate and self-direct learning may well depend on the level of exiting knowledge and skill in the domain” (Rubenson, 2011, p. 42) . In fact, the theory of cognitive aging holds that it becomes more difficult to self-initiate processing and that age-related difficulties in learning can be ameliorated to a large extent by the availability of environmental supports to guide processing.

Mandel (2017) states the main difference of andragogical model of learning and pedagogical: “in contrast to the pedagogical, the andragogical model of learning is built on the basis of the educational needs of adults, that is, in the clearly expressed conscious needs for mastering the knowledge, skills, abilities and qualities provided by the prognostic model of competency that a student needs to master in order to solve his vital problems” (Mandel, 2017, p. 229).

Additionally, Knowles (1968) aimed to showcase how the learning process in adults is distinctly definable and also helped to identify the learning styles which suit adults the best. Over the years, this theory evolved and implemented. At its core, this theory contains five key assumptions about the characteristics of adult learners. The characteristics are:

1. Self-concept

As a person matures his/her self-concept moves from one of being a dependent personality toward one of being a self-directed human being.

2. Adult learner experience

As a person matures, he/she accumulates a growing reservoir of experience that become an increasing resource for learning.

3. Readiness to learn

As a person matures, his/her readiness to learn becomes oriented increasingly to the developmental tasks of his/her social roles.

4. Orientation to learning

As a person matures his/her time perspective changes from one of postponed application of knowledge to immediacy of application and accordingly his/her orientation toward learning shifts from one of subject/centeredness to one of problem centeredness.

5. Motivation to learn

As a person matures, the motivation to learn is largely internal (Knowles, 1984).

The flexibility and inclusiveness of this theory shows its applicability in a gamut of different industries and works productively for common training courses, like soft-skills.

By conducting the survey to accumulate inputs from the OSH workers in Latvia, the factors that influence OSH training can be clearly identified. That will, in turn, lay the groundwork for the subsequent research to assess industry's readiness to adopt gamification as a feasible method of OSH learning.

3.2 Corporate education

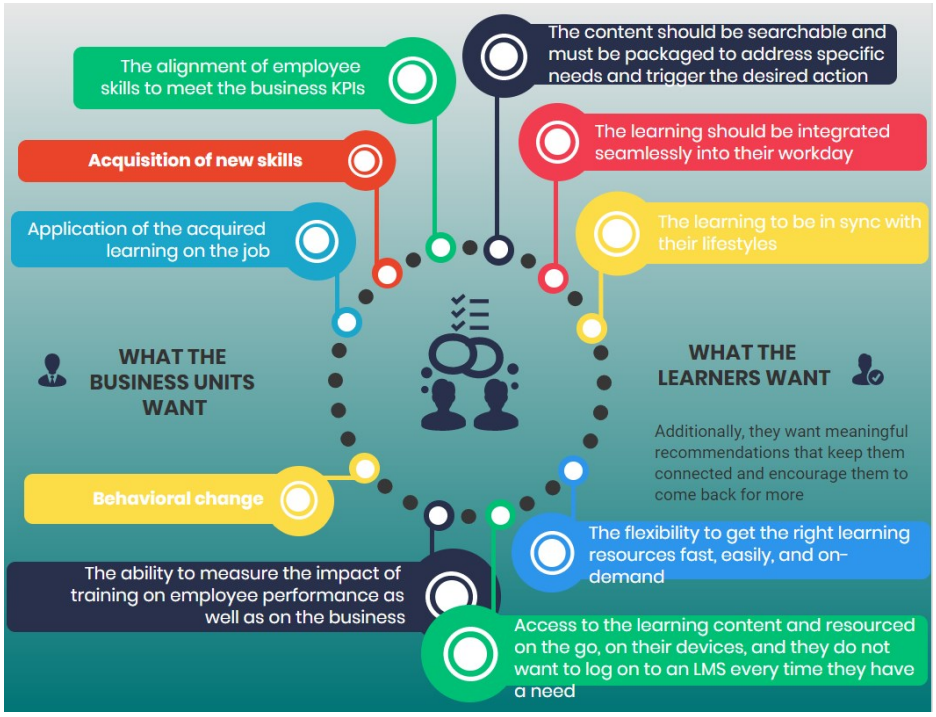
Concepts of adult learning impact corporate training since once we understand how the adult mind connects with the process of learning, we can use that knowledge to enhance the performance of workers.

Any adopted method of learning should serve two key objectives: 1. Focus on attainment of workers' goals, and 2. Realisation of company's goals.

Ideally, the objective of an organization should be to motivate workers to achieve learning goals to optimize productivity and reduce hazard incidents. Therefore, there are two main questions: 1) What does the company want? 2) What does the employee want?

In general workplace-based learning is attractive to workers (Findley et al., 2012, p. 524).
Asha Pandey, in her book "eLearning Trends in 2020 – Featuring Tips on How You can Leverage Them for Learning, Performance Gain, and Behavioral Change" writes about what the business units and learners want (Figure 2.).

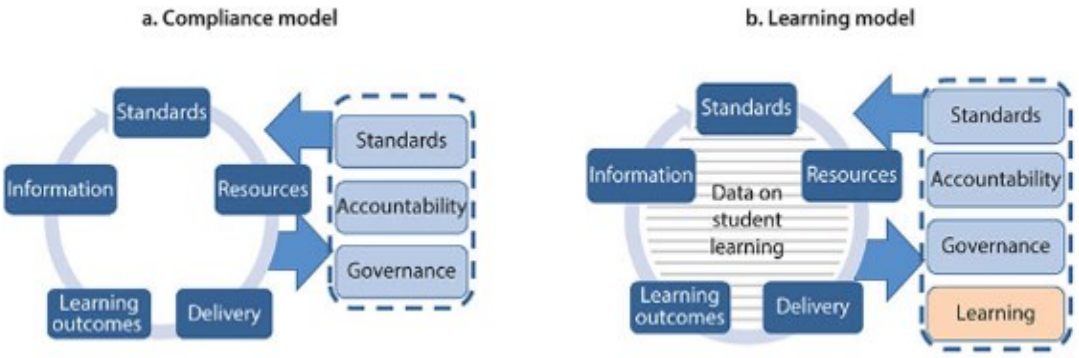
Figure 2. The expectations of business units and learners. (concept ref. Pandey, 2020)



Aside from what both sides want, there is compliance training that must be met.

Today, compliance and regulatory rules shape much of workplace learning. In some organizations, as much as 70 percent of learning, as measured by worker hours, is dedicated to training or retraining employees on topics defined by mandated regulatory courses (Masie, 2014) rather than looking for growth and development of the business. The transition from a compliance-oriented system to a learning-oriented one, is encouraged by the organizations as this results in tangible benefits in terms of reduces adverse incidents (WBS, 2017). To put it more specifically, it involves a key change in perspective where information is seen more as a static monitoring tool, and used to provide feedback to a larger information system which can be used in several ways to improve teaching and learning, as well as overall management and planning. Information on the quality of learning plays a crucial role in Occupational Safety and Health learning (Figure 3.)

Figure 3. Moving from compliance to learning (From Compliance to Learning: A System for Harnessing the Power of Data in the State of Maryland (World Bank Studies, 2017, p.333)



Organizations can achieve a variety of goals with trainings.

"Organizations develop training because they value their workforce and recognize the benefits." – stated Julene Brown, Vice President of Compliance and Audit/Chief Compliance Officer at Essentia Health (Journal of Health Care Compliance, 2016, p. 37) A good example of a well organised learning solution for corporate training is the one, that was implemented in *Raythion Co.'s Global Trade organization.* As it has reduced compliance violations by over 90% and their sales have grown each year since. They organised the process based on four layers of learning: awareness, knowledge, capability, and performance. The first layer, awareness training consisted mainly of online courses addressing the key points why this compliance training is significant. The second layer, called the knowledge layer, which also included mainly online courses, addressed what the regulations entail, and what each person must know and be able to do in a particular role. The third layer – capability, explained how individuals could accomplish their responsibilities on a granular level. The final layer – performance, which consisted primarily of instructor-led, hands-on workshops and allowed individuals to fulfil their responsibilities excellently (Bordonaro, 2019).

Safety Training

Employee safety training is a fundamental component of any corporate compliance program. If the regulation, policy or standard does not explicitly require employee safety training, almost invariably, the corrective or preventive action resulting from root-cause analyses of incident investigations, ISO 14001 audits or job safety analyses results in recognition that part of the solution is some nature of employee training. Nevertheless, the method of application and level of engagement in safety trainings are different in terms of the instructor's role, learner motivation, verification of

competency and measuring effectiveness, as the degree of hazardous and/or the dangerous consequences elevate.

3.3 Distance Learning, E-Learning

According to Encyclopaedia of Educational Psychology, one of the earliest instances of distance education occurred in the early 1840s, when a series of lessons were mailed to students across the country (Salkind, 2008, p. 261). Distance learning, as a web-based course, first was introduced in 1995 by professor of art at Penn State University (Maddox, n.d.). Since then, distance learning has rapidly evolved and "occurs when the instructor and students are separated by physical distance and technology is used to bridge the instructional gap" (Boaz et al., 1999).

The term e-Learning was coined in 1997 as a learning that takes place through internet; learning on internet time, the convergence of learning and networks (Rogers, 2009, p. 39, Cross, 2004, p. 104). Cross (2004) observed that e-learning is less connected and influenced by the formal training in the realm of academics, and he insisted that the objective of e-learning can be greatly achieved by controlled manipulation of the learner's thought process and his performance at the workplace. In 2001 the Report of the Commission on Technology and Adult Learning defined e-learning as "instructional content or learning experiences delivered or enabled by electronic technology" (Bonk, 2002, p.23). All the definitions suggest, the connection between learning activities and technology.

Avakova – online projects manager in SKOLKOVO, used to work as an e-learning Manager in "MTC" states that: "The development of the corporate market for e-learning is guided by the principle of andragogy and the primary goal of the company is to make training practice-oriented and integrate it into the work process. ... The role of the producer in this case is to determine the topic, goal and objectives of this training and justify which online formats will be optimal for the company and employees based on the specifics of the content for the audience and financial availability." (Eliseeva, 2020, p. 75) It is suggested that theory is mirroring in world practice as well.

Despite possible advantages of distance learning in corporate education, the implementation of this method is slow due to several reasons. According to statistics (Statista, 2020), about 20% of households in developed countries don't have computers which may come as a serious topological handicap in implementing the method. Thus, it is necessary to increase the level of technology

penetration and computerization among workers. Because if distance learning is used wisely, it can contribute directly, and indirectly, to increase industrial productivity and profitability.

Challenges with distance learning have also been noted by various researchers. Graeme (2009), states that using technology in distant education:

- May not provide any educational benefit and, in some cases, may actually interfere with learning process and quanta;
- Put institutions to face global competition, unprepared (i.e., inadequate, and untested readiness of the learners who then seek employment in the global job market);
- Students with limited or no Internet access are the losing lot as they simply can't be a part of such learning methods;
- Increase in learning cost in terms of the purchase of computer hardware, leasing internet connections, printing etc.;
- Technical reliability and obvious disadvantages of machine dependence;
- Restrained or limited pedagogical practise (e.g. simply putting lecture notes on the Web);
- Information excesses;
- Psychological barriers due to technology intimidation;
- Increased amount of workload;
- Lack of peer group studies, physical level interaction, sense of aloofment;
- Obvious health issues connected, including eating disorder, due to lack of physical movement and prolonged exposure to computer.

Even though challenges are evident, the e-learning market is expected to significantly grow in the next five years (Research and Markets, 2020). COVID-19 [2] has accelerated the development of e-Learning and played a significant role in a growth speed of distance learning.

Learning Management System (LMS), which enable collaboration of content, testing material, and information exchange among peer groups both in the academic and corporate world, is likely to

[2] COVID-19 is a disease caused by a new strain of coronavirus. 'CO' stands for corona, 'VI' for virus, and 'D' for disease. Formerly, this disease was referred to as '2019 novel coronavirus' or '2019-nCoV.'

grow due to the rapid proliferation of smartphones, and the development of interactive and gamified learning platforms (PR Newswire, 2020). To illustrate the value of using a learning management system and to provide evidence of compliance for the authorities in regulated industries, several key benefits were found, such as:

- ability to deliver education to its staff at times that are convenient to them;
- empower managers to develop and monitor individual employee education plans;
- eliminates a significant amount of travel and save money;
- give supervisors a real-time snapshot into who has taken compliance training and how well they have understood the subject matter (Little, 2005).

The recent years have witnessed a tectonic shift in the way learning is delivered (Pandey, 2019). An extension of e-learning is mobile learning (m-learning) (Brown, 2005). Rapid, extensive adoption of mobile learning (i.e., mLearning) allows education to be delivered on learners preferred device (including tablets and smartphones) in adoptable formats. M-learning: The use of mobile technology to provide “anyone-anytime-anywhere” learning (Rogers et al., 2009, p. 809). However, the same problems apply to m-Learning, that were mentioned earlier. Mobile is just a tool with its own set of possible benefits. However, the advancement of mobile technology and acceptance of mobile as a multipurpose device, including that for learning, has greatly supported distance learning and increased the possibilities of implementation.

This shift to mobile has triggered a rethink and thereby a substantial change in the architecture of most learning solutions. The impetus is now on designing engaging and engrossing learning solutions that can grab higher interest and approval from the changing learner demographics that now has a significant percentage of millennials. It is observed that modern-day solutions tend to grow an ever-increasing amount of reliance on Micro-learning and also expand the use of videos and Social Learning platforms.

Both these trends provide a base and a perspective of justification to adopt Gamification-based learning which can be deployed on mobile devices in learner-friendly, innovative formats. Such learning can be crafted in a way that resonates well with the learners, leading to higher retention and prolonged engagement.

4 IMPORTANCE OF OSH TRAINING

To establish a scope of current available OSH training methods, a literature review was conducted about practices that are relevant, contemporary, and pertinent to the industry. Occupational Safety and Health is a broad-spectrum field of study; therefore, this research solely focuses on the industrial, machinery and construction sectors because of its acknowledged high-risk working environment.

The consideration for workers' safety and health is not merely a national issue, it's a fundamental concern to the world economy. The human cost of this everyday adversity is vast, and the economic burden is immense. Worldwide, the OSH related illnesses, injuries and deaths result in to about 4 per cent loss in global GDP. Occupation related illnesses are relatively are on a rise.

The construction industry is known as the 4D industry: Dirty, Dangerous, Dark and Death (Bakri et al., 2006). For a reference, Department of Occupational Safety and Health Malaysia (DOSH), mentions the construction industry as the one with third highest accident rate, after manufacturing and agriculture industries. (DOSH, 2019) According to the Latvian Labour Inspectorate report of 2018 the industrial sectors reported the most number of incidents at work, within which construction sector ranked within the top 4 (1439 accidents out of a total of 1916).

Hazardous sites require a functional OSH management system for the safety of the workers. Depending on the activities that will occur at the site, it may be necessary to include procedures relevant to those activities. Information about the surrounding area is also important for contingency planning, including evacuation blueprint. Preparation is the best method for response to the incidents. "By conducting pre-emergency planning, personnel can define roles and responsibilities" (Martin, 1999). Nowadays, much of the lifecycle of workers involves multiple employers and possibly different jobs. Therefore, "the importance of worker training on emerging workplace risks and hazards… should be a key element within social dialogue on adaptive approaches for lifelong learning initiatives" (ILO, 2019, p. 41).

According to statistical data from a model emerging economy like Taiwan, safety education training was instrumental in reducing the rate of accidents per thousand workers from 4.12 in 2001 to 3.61

in 2008, a reduction of 14.568%. During the same period, the rate of injuries per thousand workers dropped from 3.76 to 3.18 (Ho & Dzeng, 2010). Safety training has real safety effects on days-away-from-work incidents, especially in smaller firms (Waehrer, 2009).

The National Institute of Occupational Safety and Health (NIOSH) of the USA, aided by federal agencies, government initiatives and financial assistance, provide training to increase awareness and to enhance knowledge among safety among workers from the Construction Industry. Various types of training are regularly carried out to facilitate inclusion, i.e., workplace training, competency enhancement programs, seminar, and forum. However, the routes to impart knowledge to the target audience have always been non-experimental and classic by nature i.e. lectures, video demonstrations and hands-on. Training methods, including competency and other type of trainings, have been found to be not sufficiently emphasizing on hands-on approach. Undoubtedly, practical-based approach is imperative for any kind of safety training. However, the very nature of hazards restricts practical-based approach in real-life situations. (Mohd et al., 2019)

High quality OSH training programs are imperative for workers and extremely important for those who deal with dangerous equipment. Inadequate training can lead to grave injuries and even fatalities. Therefore, it is well recognized that an effective safety and health training program can significantly bring down health hazards and fatalities. Despite the significance and obvious consequence, OSH training programs have been the topic of less research than one might expect.

Study of OSH training largely concentrates on two interrelated areas. The first area is the worker attitudes toward their training and how good is the worker's knowledge and how agile he is in implementation of the acquired information**.** The second area of focus is on the quantity and nature of training that workers need to receive. Eventually, very small number of published researches exists in the public domain on the adequacy and precision of instruments that are used to assess and evaluate the worker for what he learnt from OSH training (Minor, 2005).

4.1 Overview of occupational safety training in Latvia

Several standards promoted by the Latvian chapter of the European Agency for Safety and Health at work (OSHA) explicitly obligate the employer to educate and provide trainings to their employees in the safety and health aspects of their job responsibilities.

Figure 4. describes protocols, information and guidance relating the key institutions involved in designing and monitoring the Occupational safety and health (OSH) system in Latvia. Key institutions include:

1. State Labour Inspectorate (SLI) – It is the key control and supervisory institution in the field of labour protection operating under supervision of Ministry of Welfare.

2. State Social Insurance Agency (SSIA) – It is the only institution that extends insurance support to organizations and the individuals against injuries, disablement and death. The Law "On Compulsory Social Insurance Against Accidents at Work and Occupational Diseases" prescribes "implementation of preventive measures to improve the working environment, to educate employers and employees, to prevent accidents at work and occupational diseases" as one of the key tasks. SSIA is cooperating with different institutions; one of which is The Institute of Occupational and Environmental Health (IOEH). IOEH conducts training sessions, imparts information, engages in research works and provides expert consultations in the domain of accident prevention and general measures of safety norms at work. IOEH works seamlessly with organizations and their workers to elucidate the rationale beyond the training policies adopted, training materials used and at the same time dissemination of the content on the Internet. IOEH has created online content and archives dedicated to Occupational Safety and Health issues which is accessible to students and other interested parties.

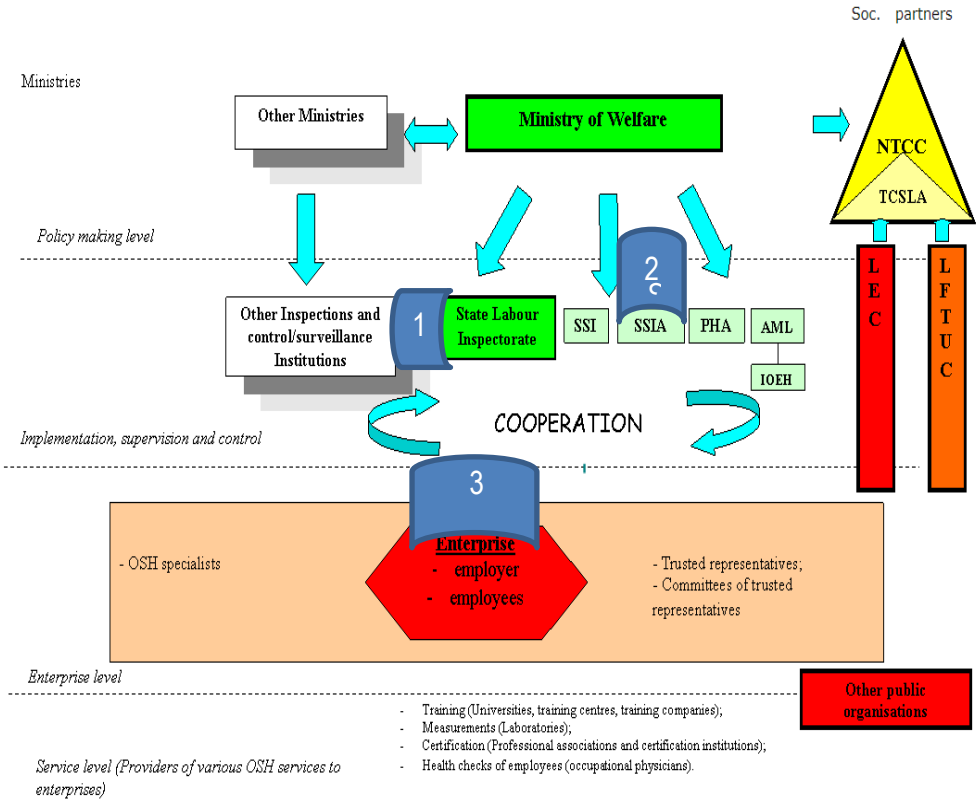
3. Enterprise level – involves three key stakeholders in relation to OSH training: a) employer b) employee c) OSH specialist.

- Employer – Responsible for enforcing training methods and ensuring compliance to safety standards that meet the labour protection normative requirements within the enterprise. Employer is expected to and is assigned with the responsibilities of providing instructions and training of workers and entrusted representatives in the field of labour protection.
- Employee – Employee is the human resource that's hired by the Employer who is expected to take part with keenness and a positive mind frame to learn from the instructing and training sessions organized by the Employer in the field of labour protection;
- OSH specialist – Assigned by the Employer, an OSH specialist can be an Employee on payroll or an external entity hired as a consultant whose primary responsibility is to engage

in training for the organization, take control of labour protection activities and establish an internal surveillance system to ensure safe working environment. Additionally, an OSH specialist is assigned with tasks like risk assessment of working environment in the enterprise, review of safety adherence protocols by the Employees etc. An OSH specialist, by evaluating the risks in the company and based on the requirements of the regulations, decides on the training that is needed for the employees.

There are other public organization that are involved in workers training, such as Universities, Vocational training institutions, training centres, training companies and Individuals (OSH specialists).

Figure 4. Current institutional system of Occupational safety and health in Latvia (OSHA, n.d.)



In advanced level training program, there is clear communication about tasks or activities that trainees are expected to perform and skillset and knowledge that trainees are expected to achieve.

Such a communication come in form of a curriculum learning objectives around which training instructions are formulated. The quality and extent of learning are assessed through written tests and other performance measures that properly correspond to training objectives.

As mentioned earlier, it is important to ensure that all present and future workforce, working in industrial environment, are exposed to different risk factors and thus provided with appropriate and adequate Occupational Safety and Health training. However, since this is a task assigned to private institutions that are largely independent and are not controlled by the government, an absence of standard curriculum can be seen with a lack of homogenization and synchronism.

The Cabinet Regulation No. 749, adopted in 2010 "Regulations Regarding Training in Labour Protection Matters" does not provide guidelines for the employers to provide health and safety training and instruction to employees. Although Section 28. does mention that "Thematic training of employees pertaining to labour protection issues shall be performed by a labour protection specialist, a competent authority, a competent specialist or another person competent in the matter".

Currently the classification of trainings is as follows:

1.First Aid course;

Instruction at the workplace; work environment risks; fire safety briefing;

2.Thematic briefings (climbers, work with cranes, hoists, fire-hazardous works, voltage-active works, etc. hazardous works);

3.Extraordinary (additional) briefings (after accidents or serious violations in the company, or changes in the company's operations (new equipment, working methods, etc.);

4.Introductory training, on-the-job instruction, work environment risks, fire safety instruction.

In 2010, the Free Trade Union Confederation of Latvia had developed guidelines to assist employers in imparting the Health and Safety related information and instruction to their employees. Among other related information this guideline will also help the employers to: 1) determine whether a worksite problem can be resolved by training; 2) determine what kind of training, if any, is needed for that.

Additionally, under the same EU project in 2010 the Free Trade Union Confederation of Latvia had formulated a training framework “Occupational safety training methods” expecting to help to: 1) identify goals and objectives for the training; 2) design learning activities; 3) conduct training; 4) determine the effectiveness of the training; and 5) revise the training program based on feedback from employees, supervisors and others.

An analysis of the training framework reveals that it is structured only for offline trainings. Neither hands-on training method nor actual demonstration, except using digital instrument such as presentations and video, found reference in this policy framework.

No mention is made of methods such as gamification in this framework. However, ‘quiz’ as a method of gamification finds mention in a section of “evaluation method”. Although it is clearly lacking more contemporary tools and training methods, the framework provides employers with a model for designing, testing, customizing, and upgrading the training programs. This framework can be used to develop training modules for a wide range of occupational safety and health hazards that are already identified at the workplace. Additionally, it can assist employers in their efforts to meet the training requirements in current and future occupational safety and health standards.

Vocational learning institutions for Occupational Health and Safety are currently providing training to workforces. Additionally, the Labour Inspection – Occupational Safety department is providing consultation service for the employers. Notably, Occupational Safety Law states that the onus is on the employer to ensure and validate that the worker has learned and understood what the worker was taught.

As per the OSH safety rule, the employer must verify the adaptability of the learner to ensure that he puts in use what he has learned from those training sessions. However, nowhere in documents any method/protocol is mentioned, using which an employer could verify the adaptability.

In the document, Strategy for the Policy of the Labour Protection Field 2016-2020 identified problems, mentioned are: “lack of auxiliary materials for training and instructing of employees, non-sufficient understanding and performance of requirements of laws and regulations, lack of knowledge and unwillingness to obtain additional information, to learn and comply with the requirements, are possible causes of the low level of awareness of persons employed in small-

sized and micro enterprises" (Cabinet of Ministers, 2016). As a result of the measures taken to date, a sizeable quantity of materials, interactive tools and updated information on a wide range of labour protection issues are available to the public. at present.

4.2 A safety training model

A workplace safety training model evolves around the knowledge and awareness about the challenges met by workers in dealing with issues pertaining to resolving adverse incidents at the workplaces. A safety model aims to deliver knowledge to the workers to deal with injuries, empowers them to be skillful to avoid injuries without affecting the productivity, and to seamlessly adopt the newer safety norms.

As earlier mentioned by the author, Section 28 of The Cabinet Regulation No. 749, adopted in 2010 says that "a labour protection specialist or a competent authority should be in charge of a Thematic training of employees" This guideline is entirely silent about a policy directive for the employers to provide health and safety guidelines to their employees". Typically, the training requirements are mentioned in the Cabinet Regulation in connection to particular jobs, and cover few details such as who is to be trained and frequency with which training is to be conducted. Over the years, the training requirements by training centres and other institutions were derived from the organisations' insight-based inputs. As a result, institutions have developed their own, independent, training models.

The author believes that the standardization and uniformity in designing of prime training parameters can improve the quality level of the training, in Latvian context. Few mentionable references of good practises are American National ANSI/ASSP training standards; ASSP stands for American Society of Safety Professionals. Using as an example ANSI/ASSE Z490.1-2016 that covers all facets of training, from development, delivery and evaluation to management of training and training programs. According to ASSP's Council on Practices and Standards (COPS), the criteria were developed by combining accepted practices from the training industry with those in OSH. The standard is intended to apply to a broad range of training and training programs, (Professional Safety, 2016) like ANSI/ASSE Z359.2-2017 – Minimum Requirements for a Comprehensively Managed Fall Protection Program.

Z490.1 – 2016 includes seven different sections:

1. Scope, Purpose, and Application;
2. Definitions;
3. Management of a Comprehensive Training Program;
4. Training Program/Course Development;
5. Training Delivery;
6. Training Evaluation;
7. Documentation and Recordkeeping.

The author came across a legacy OSH training model of 1979 where training guidelines describing a workflow model containing a checklist of the following benchmarks:

1. Determining if Training is Needed;
2. Identifying Training Needs;
3. Identifying Goals and Objectives;
4. Developing Learning Activities;
5. Conducting the Training;
6. Evaluating Program Effectiveness;
7. Improving the Program.

It shows that this legacy model is extremely scalable and is agile to adopt and implement itself, no matter what the size of industry. The goal can be achieved without engaging professional trainers or without investing on expensive training materials. That makes it an essentially adaptable model for SME segment of businesses. Using this model, an organization can develop and design safety and health training programs which can address the problems specific to their own businesses, can fulfil the learning needs of employees, and thus strengthen the overall safety and health program of the workplace (Occupational Safety and Health Administration, 1985).

A safety training program, once designed, should be validated by a specialist before implementation. Nevertheless, if the nature of work is not highly hazardous and the size of trainee group is too small, a point-based self-evaluation/assessment of the designed program can be carried out. In larger organizations, the same curriculum evaluation can be done at both user and expert levels on the following points.

The best training programs are accurate, credible, clear and practical. Training providers and instructional facilitators who recognize and embrace characteristics of sound training and principles of adult education will maximize the benefits of the training for their participants. Apart from paying attention to the training program and ascertaining the facilitator's credibility, the quality of the training facility should be kept in mind as well. Ideally, training facilities should have sufficient resources and equipment to perform classroom and activity-based learning in a setting conducive to effective learning.

4.2.1 Training Materials

Wikis, blogs – a place to keep written safety training programs so workers can review them when they need to (Dalto, 2014).

Handouts, PowerPoint presentations, or flip charts, are often used as visual aids to facilitate and enhance a student's learning experience. One should note that the these are visual aids that enhance learning experience and are not teaching techniques (US department of labor, 2015). As example, brochures containing representative images distributed to farmers and landscape workers positively influenced the adoption of hearing protection devices (Smith et al., 2008).

Video and interactive exercises are for raising awareness and to help equip learners to become partners in workplace safety and health (NIOSH, 2007). It is suggested that a training coordinator be present to stop the video at varying points and discuss issues with the trainees (Russo, 2000).

4.2.2 Training techniques, methods and modes

Evidence-based adult learning techniques should be at the core of training development and delivery as mentioned by several organisations and individuals involved in OSH training (US department of labor, 2015, Dalto, 2018). For example, the Delphi technique old yet relevant, applies expert input in a systematic manner by using a series of questionnaires with controlled opinion. It was developed in the 1950s by Helmer, Dalkey, Gordon, and their colleagues at the RAND Corporation with the support of the US Army Air Corps (Chen et al., 2016). Peer-to-peer training with activity-based learning with computer-based training (CBT) can also augment the

effectiveness of safety and health training for workers, (US department of labor, 2015). The list is not limited with social media, mentoring/shadowing, instructor-led training such as formal classroom-style training, safety meetings (Dalto, 2014). Although, “training involving behavioral modeling, a substantial amount of practice, and dialogue is generally more effective than other methods of safety and health training” (Burke et al., 2006, p. 315).

Increasingly, organizations are looking for newer, cost effective alternatives with lesser footprint. Models using cloud-based learning systems, social networks, project-based learning (tasks to do independently or in small groups) (Alfaro et al., 2019) etc. are increasingly finding acceptance among employers. To their advantage, most of these online safety trainings are delivered asynchronously and are self-paced. Training can range from highly interactive nature where from text, voice narration and animation for an immersive experience to simple PowerPoint slides’ deck with multiple-choice or true/false quiz are widely used (Greene & Cheryl, 2019). Studying textbook materials and sitting exams are considered as old-fashioned learning methods (Xu et al., 2019).

In every OSH training course, there should be an emphasis on the need for self-learning and its continuing practice (Stellman, 1998). According to Goetsch (1993) one of the fundamental principles for learning is “learning by doing”, underlining the significance of practical learning opportunities for learners. There are several approaches to the development of safety training programs. As a result, some researchers have explored other methods to update the delivery of safety training, especially on the advantages of using technology to create safety training modules (Xie et al., 2006; Ho & Dzeng 2010). By using technology, training has become more flexible in terms of time management, cost and experience (Qin et al., 2016).

Virtual reality (VR) - is one of several technologies receiving attention for its potential use in education, with both the EU and USA launching initiatives for the large-scale implementation of digital technologies in the classroom (European Commission, 2018; U.S. Department of Education, 2017, as cited in Meyer et al., 2019). A VR simulation-based safety training program can offer an engaging and interactive tool for training all construction workers on electrical hazards and safe working procedures (Zhao & Lucas, 2015). When it comes to, for example, lift truck operator training, as founders of *Really-Virtual Corp.* [2020] explain, VR can help to determine early on if someone is suited to operating a lift truck in the first place. Furthermore, VR also helps operators to develop and demonstrate additional skills for career advancement and it can also be used with

experienced operators. VR training is a powerful training tool that makes operators safer, more proficient and less damage prone from day one, reducing accidents out on the floor His views are based on the results of roughly 100 installs at 80 companies. One of which *GE Appliances' DC* that by tailoring the software to the specifics of the situation, also reduced training time by 50% while there was no risk to drivers. (Forger, 2020). In another instance, *Tyson Foods* with VR safety training, experienced more than a 20% reduction in injuries and illnesses compared to the year prior (O'Donnell, 2018). VR training is more effective in terms of maintaining trainees' attention and concentration (Sacks et al., 2013), as well as enhancing the trainees' "confidence, the intuitiveness, and performance scores". (Juang et al., 2013, p. 516)

However, advanced technology such as Virtual Reality (VR) requires some high-end hardware and software which can be costly and limited to researchers who have access to this technology because of the availability of funding for their research (Ebersole, 1997). Hence, as highlighted by Filigenzi et al., (2000), there is a need for affordable technology. Affordable technology is a technology that can be developed using a simple software but is capable to generate the same experience offered by other more advanced and expensive applications such as web-based training, learning via CDROM and games (Charsky, 2010).

Gaming is an approach that uses multiple technical aspects to extend a near-real experience which includes interactive training sessions and providing reinforcement to the theoretical aspect of it by exercising some real case scenario (Assfalg et al., 2002). **Simulations using gaming** proves to deliver better results, are more productive and it has proven benefits in terms of cost and retention of knowledge in comparison with conventional classroom teaching (Kirriemuir & McFarlane, 2004). It is observed that by actively participating in the process of acquiring knowledge, learners take control of their own learning by observing and "doing". In such cases learners are likely to retain about 30% of the acquired information which, invariably, contribute to their knowledge. As observed, this percentage may go higher up to 90% (Goetsch, 1993).

As an example, in New Zealand the transportation department used technology to develop a driving simulation to measure and rate the awareness and decision-making capability among newer drivers in identifying hazards (Isler & Isler, 2020). In another instance, in the Department of Construction Management - the University of Washington, students were introduced and exposed to a 3D-video game system developed for safety education (Teizer et al., 2013). In Ireland, a simulation game

known as MERIT (abbreviated from Management, Enterprise, Risk, Innovation and Teamwork), originally developed by Loughborough University in the UK, was integrated into the blended learning module to accommodate the needs for Continuing Professional Development (CPD) among construction professionals (Wall & Ahmed, 2008). There are several advantages of game simulation over a real experiment, such as: a) the consequences of the adopted decisions are obvious b) the time scale can be changed (the game allows one "to live faster" c) the game can be played several times under different initial conditions (Gidrovich & Syroezhin,1981).

Unlike simulations using games to enhance learning experience, gamification ensure an elevated level of motivation among workers and to spur meaningful engagement. It was concluded by German and United Kingdom researchers that gamification influence pro-social behavior. Fulfilling the duties safely not only helps protect one, but also his colleagues. Many organizations want to change the attitude of employees toward safety for the better (Kapp, 2012). As a reference, *Liquid Trucking* which has terminals in Nebraska and Iowa (United States) use gamification since 2013. "Besides earning points for completing safety training online, drivers also can benefit from a number of other rewards categories such as violation-free logbooks and having no accidents." (Huff, 2018, p. 48) In Canada*, Driver Challenge* application developed by *d2go*, is used by Transport Grayson to help efficiency and safety of fleets. Another gamification solution for trucking is *Telogis Coach (*Commendatore*,* 2017*)* developed by privately held US-based company. Via a mix of smart tech and behavioral psychology, the emerging innovations use gamification to motivate operators and reinforce good habits (Frey, 2015).

Online alternates like eLearning channels, provided by the safety supervisors, work towards making OSH training interesting and to promote meaningful engagement. While feasible efforts are evident in allowing workers to buy online safety courses that are convenient and affordable, those eLearning modules have largely been less effective in imparting information and interest retention than a method like gamification (Triple Crown Construction, 2019).

Employees typically dislike safety training. OSH trainings assigned to employees (e.g., safe lifting, stormwater compliance, workplace violence) are often perceived as official/statutory requirements that they are required to sit through (Greene & Cheryl, 2019). Thus, a measured blending of motivational elements with essential learning materials is of paramount importance.

From the perspective of methodical approach, a more structural model emerges which clearly outlines the teaching and learning aspects to be taken into consideration. In the work “Safety Orientation and Training for Teacher Aides in Special education classes” participants rated the training series on various criteria including

- Relevance – Information given vs. information expected and/or needed;
- Appropriate training methods – How the training methods emulated real-time situations and guided to the solution;
- Clarity of presentation – how clearly the information was shared with the recipients;
- Clearly expressed educational philosophy – explaining the aim of the study clearly to the attendees;
- Effective utilization of teaching materials – using right kind of materials like diagrams, charts, slideshows to create optimal impact;
- Use of examples – analogies and examples go a great way to help remember things as those insert contexts to ideas;
- Program specific adaptations – making the teaching method flexible based on the teaching content;
- Opportunity for participation – encouraging the attendees to question, comment or even argue on subjects, during the process of imparting information;
- Appropriate use of feedback – making sense of attendees’ feedback by incorporating their concerns in the following sessions to make the process more inclusive;
- Outlining of important material to emphasize awareness and safety – placing the crux, importance-wise, above the mundane details to help the learner to not lose perspective;
- Summarizing the important details - to maximize understanding and reinforcement around the most important points;
- Reduce performance expectations to a reasonable minimum to set the bar not too high;
- Appropriate assessment and evaluation materials – to ensure a greater degree of satisfaction at the end of the training program (Gittman, 1989).

From the perspective of a psychological approach, an emotional intelligence-based model, developed by Weinstein (1997) (Table 2.)., adequately covers the ground. As per the model, there are 4 kinds of training which are based on 3 different levels of motivation.

Firstly, the basic courses, that are based on fear. For example: If you climb up a ladder without support, you might fall and die or receive severe injuries. Secondly, the going through courses, instructions and knowledge checkers. Those are largely based on the second level of motivation – punishment. For example: If you fail to pass the test, you won't be allowed to work. Thirdly, instructions and support, and rewards based positive competition. For example: John was always wearing protective equipment and accumulated 100 points. He later redeemed the points for a gift.

According to Weinstein (1997), the best type of adult training that can lead to continuous improvement, and excellent results are good practices, setting examples, positive competition, self-education. These are all motivated by learning methods that bring out the inherent attributes of being resolute. Weinstein's work encompasses the learners of all ages and corroborate the fundamental argument in favour of gamification.

Table 2. An emotional intelligence-based model. (Weinstein, 1997)

Levels	**Variables**			
	Motivations	**Nature of the actions**	**Training**	**Results in the area of occupational safety and health**
I	Fear	Passive	Basic courses	Incomplete compliance, results worse than average
II	Punishment	Reactive	Courses, instruction, checking	Full compliance, no improvement, average results
III	Rewards	Active (understanding, trust)	Instruction and support, positive competition	Correct behaviour, results better than average
IV	Internal motivation	Proactive (passion, commitment)	Good practices, examples, positive competition, self-education	Continuous improvement, leadership excellent results

Here' its noteworthy to mention the research by Baxter et al., (2017) which suggests that gamification may provide some intrinsic motivation to engage learners. This is found to be effective in settings where financial incentives and other forms of external motivation are not feasible. Baxter et al., (2016) established that the gamified training system is fun, enjoyable, and preferred over other methods.

5 GAMIFICATION

Digital Gamification, as a field of study, is still in its nascent stage. It has been defined in several possible ways.

The most cited definition is - “the use of game design elements in non-game context” (Deterding et al., 2011, p. 10). This definition has its limitation as ‘game design elements’ have never been clearly defined and are forever evolving. And yet, there are two main perspectives in definition of gamification that are commonly discussed. These are:

1. Zichermann and Linder (2010): “A tool to reinforce branding advances through the use of game elements and dynamics”. They diagnosed the motivation triggers from a psychological perspective, and broke it down to intrinsic motivational elements like (a) desire to learn that emanates from within the user thanks to his inner values, (b) extrinsic motivation — a form of desire fuelled by the probable and tangibly beneficial factors like money, job, promotions etc. (Seaborn & Fels, 2015)

Same authors discuss attracting the customers/audience and use it in training, In their book “The gamification revolution: how leaders leverage game mechanics to crush the competition” (2013), they mention that “gamification is the process of engaging audiences by leveraging the best of loyalty programs, game design and behavioural economics.” (Zichermann, 2013, p. 133)

2. Hamari et al. (2014): “A process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioural outcomes”. In this cited article, they observed that gamification techniques can be treated as motivational affordances which, in turn, will result in certain psychological outcomes.

Although, Burke (Gartner, 2014) is widely cited, his definition was not seconded by important voices in the field, because of its self-limiting use of the term “digital”. It defines gamification as “the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals”.

For the purposes of this study, the concept of gamification is considered by the author as a perceivable outcome of design philosophy which can be used to construct an interaction with the learner with or without the help of technology. To create a fruitful gaming experience, author sees the game elements as essential building blocks.

5.1 Game design elements

Deterding et al. (2011) categorised game elements by game design levels:

- interface patterns;
- game mechanics (e.g., time constrains, limited resources, turns);
- game heuristics;
- game models; and
- game design methods (e.g., testing, play centric design, participatory design).

These same set of game elements are named by different authors but they established the correlation between the elements in different ways. For example, Hunicke et al. (2004) *suggested* the MDA (mechanics, dynamics, and aesthetics) model that applies a methodology based on correlation between designer and user, to understand the game design rationale. In his methodology he used all these elements as components for game designing

Werbach and Hunter (2012) underlined the correlation between Game Dynamics, Game Mechanics and Game Components. This correlation, while elaborating the cohesive strength of a gaming system, also subtly sends out the message about why seamless integration of Game Dynamics, game Mechanics and Game Components is key to the success of the gaming system. Blohm and Leimester (2013) linked game elements, such as game dynamics and game mechanics to motives.

Table 3. Game dynamics, mechanics and components (Werbach & Hunter, 2012; Blohm & Leimester, 2013)

Game Dynamics *(concepts)*		**Game Mechanics**		**Game Components**
Werbach and Hunter, 2012	**Blohm and Leimester, 2013**	**Werbach and Hunter, 2012**	**Blohm and Leimester, 2013**	**Werbach and Hunter, 2012**

Narrative	Exploration	Challenges	Documentation of behaviour	Achievements (defined objectives)
Progression	Collection	Chance	Scoring systems, badges, trophies	Avatars (visual representations of player)
Emotions	Competition	Competition	Rankings	Badges
	Acquisition of status	Cooperation	Ranks, levels, reputation points	Boss fights
Relationships	Collaboration	Feedback	Group tasks	Collections
Constraints	Challenge	Resource acquisition	Time pressure, tasks, quests	Combat
Action points	Development/ organization	Rewards	Avatars, virtual worlds, virtual trade	Content unlocking
Assessment		Transactions		Gifting
		Turns		Leaderboards
		Win states		Levels
				Points
				Quests
				Social graphs
				Teams
				Virtual goods

Game dynamics are about perceiving the game, while game mechanics is about building it. While game dynamics define “when and how” incentives should be presented, game mechanics regulate which and what incentives should be granted (C.-H. Tu et al., 2015).

Werbach and Hunter (2012) and Zichermann and Cunningham (2011), in their respective books, have elaborated the game mechanics in explicit details to help establish the rationale in the mind of the readers. Werbach and Hunter referred to these as game components. There is no single

commonly agreed classification of game dynamics and game mechanics. Below is a list of the most common game mechanics used in gamification:

- **Points:** Rewarding points help attain something that the system is passively encouraging them to do. Points help keep the scores, provides instant feedback on skill, creates a positive feel of advancement and in the process gives valuable data for the game designers.
- **Badges:** Werbach (2012, p.36) and Zichermann (2011, p.56) defined badges respectively as "visual representations of achievements" and "visual points system". They often used in gaming to enhance a sense of achievement and superiority among users. They are a visual representation of a specific accomplishment within a gamified system.
- **Leader boards:** Leader boards allow users to see where they stand relative to each other *and provides an invisible rating system that goes to influence the users*. Both Werbach (2012) and Zichermann (2011) warn about their use: while they can be incredibly motivating, providing a user with a goal to accomplish, *and a sense of accomplishment* they can also be demotivating for underperforming users to stop using the system.
- **Levels (Status):** Levels are the most specific and the most plausible indication of a user's progress within a game, and broadly envelops two messages. The first message pertains to the user's status and position in a system (e.g. a "level 10" user is five levels higher than a "level 5" user). Analogically, this is akin to the glass-half-full perspective.
- **Level (Progress):** The second meaning of levels *pertains* a user's position within a system. For example, a gamified system may have *6* levels or areas that a user has to *gradually* progress *to*, and a user on level *three* is only halfway through. Analogically, this is akin to the glass-half-full perspective.
- **Challenges and Quests:** Challenges are "puzzles or tasks that require effort to solve" (Werbach & Hunter, 2012, p.29). They "give players direction for what to do within the world of the gamified experience" (Zichermann & Cunningham, 2011, p.64). Usually, challenges and quests are persuasion techniques that are built as value addition to point-based systems. Such techniques are focused on persuading users to accomplish even more difficult tasks and master their skills, in turn.

- **Competition:** Competitions allow users to compete with one another, with a clear winner and loser. At *a more* basic level, the *idea* of leaderboards *appear to be a reflection of indirect competition. However, on a broader level,* competitions between users and groups determine who can accomplish certain tasks quicker, better, etc.
- **Cooperation:** The works to bring users to execute the tasks together bring a sense of collaborative approach and underline importance of teamwork.
- **Narrative:** Narrative is a "consistent, ongoing storyline", in business setting it is "corporate culture or brand" (Werbach & Hunter, 2012, p.25). In gamification, narrative is possibly of the most underrated aspects of game design. This is quite avoidable as videogame narrative or storytelling is the most compelling component of the design that helps keep the user's interest alive. (El-Khuffash, 2013)

Stretching the argument further, Seaborn and Fels (2015) listed eight gamification mechanics, thus supporting the definitions and alternatives above.
These mechanics are: 1. Points, 2. Badges, 3. Leaderboards, 4. Progression, 5. Status 6. Levels, 7. Rewards, 8. Roles

Yu-kim Chon (2019) notes Points, Badges, Leader boards (PBLs) as superficial layers in games, and merely the shell of a game experience. He stated that most professionals, including designers are only familiar with the process of implementation of PBL mechanics and completely miss the importance of engaging the users. This suggestion parallels what Kapp says in his book "The Gamification of learning and institution" (2012, p.2.) along with others such as Zichermann and Cunningam (2011), Kapp, Blair and Mesh (2014).

5.2 Gamification and its role in education

Every year, the number of educational services that use gamification in their process is increasing. These include schools, colleges, universities and other institutions of both formal and informal learning around the world, not to forget the corporates, different organizations and the government departments.

Gamification is also an emerging business practice. Many educators are looking to create an exciting and engaging learning experience, to motivate the students and boost participation in class. Gamification can be used by companies to engage, socialize, motivate, teach and retain their contributors and customers in an engaging way. It is also proposed that "learners who engage with games as part of their learning process retain 75 percent of the knowledge they acquire" (Incentive Research Foundation, 2011).

Sangkyun et al. (2018, p. 29) defines "gamification in learning and education" as follows: Gamification in learning and education is a set of activities and processes to solve problems related to learning and education by using or applying the game mechanics. This corresponds to all the previous definitions of gamification mentioned in this work earlier that included game mechanics. Although, previously the focus in definitions was on motivation and engagement of the *players*.

The purpose of gamification in education, according to Sangkyun et al. (2018) is to create real-world environments that support learning and problem solving. It is implemented within the real world. (Sangkyun et al., 2018). If gamified systems are not found to be more motivating, then they are complicating systems in current learning environments (Reiners & Wood, 2015). Gamified - training platforms are created by keeping goals beyond entertainment and the data they generate serve goals (Gilbert & Sari, 2016). Therefore, it is important to define the main organization objective and the user's objective with great precision.

Werbach (2013), has developed a framework for gamified systems, consisting of six steps:

- Definition of purpose (define business objective)
- Description of the target behaviour of the players. (delineate target behaviours)
- Description of the players (describe your players)
- Designation of the path of the hero. (devise activity cycles)
- Elements of entertainment (don't forget the fun)
- Selection of tools (to deploy appropriate tools)

Hamari, et al. (2014) suggest that gamification can have positive effects on individuals.

"Gamified training can also change habits, through repeated retrieval and spaced retrieval. Retrieval practice forces learners to recall information, rather than just listen to it or read it. On its

own, retrieval practice can improve recall performance by 10% to 20%. Spaced retrieval is providing the learner with quizzes or course content spaced over time, and when combined with retrieval practice it multiplies the effect and improves recall performance by as much as 35% to 60%" (Lawrence, 2018). Gamification is commonly not used to substitute training, but to strengthen it, effective educational material is a vital element for efficient gamification (Landers, 2014).

5.2.1 Gamification in adult education

This next section will integrate the concept of adult learning with gamification. A notable business trainer and pedagogy consultant – Smolyaninovs N., while talking about hypotheses and antitheses of andragogy, mentioned that Gamification Training methods are considered to be very popular, but "some do not digest this teaching technique "with all fibres". It is believed that emotionally designed information is remembered much better. But some serious people like boring thick textbooks." (Smolyaninovs, 2019)

Thus, it can be understood that game elements in training can also be used with success to formulate soft skills. By the definition, soft skills are personality attributes and behaviours. Unlike technical or 'hard' skills, soft skills are not about the knowledge one possesses or acquires. It is behavioural traits that they display under different circumstances. Interpersonal skills and communication skills are more specific categories of soft skills. In the context of gamification, other soft skills that can be demonstrated as effective are Teamwork, Adaptability, Conflict resolution, Flexibility, Problem-solving, Work ethic, Integrity etc.

Although, "simply adding game elements to training without carefully reasoning through the psychological impacts is unlikely to lead to desirable change and may even harm outcomes" (Armstrong & Landers, 2018, p. 167).

Millennials, as the youngest generations of adults will form 75% of the global workforce by 2025 (Deloitte, 2014). The best way to meet the training needs of millennial workers is transition to a technology-based way of learning. "The real innovative element of gamification is the digitisation of motivation and engagement. … The benefit of using gamification during studies/training is the feeling of ownership over their own learning.

Engagement is the key element, without which control over the content and quality of learning cannot be completely reached." (Polytechnic Institute of Santarem et al., 2018, pp. 17–20). "E-learning is suitable for easy and effective integration of gamification" (Kiriyakova et al., 2014, p.4).

Gamification “allows to take advantage of the knowledge retention power of the spacing effect, while keeping job disruption to a minimum. Plus, consistent exposure to information keeps it top of mind and part of the ongoing conversation, which can be critical for knowledge such as safety procedures or customer service practices” (Leeman, 2014, p.39). “A recent study of over 6,000 employees in the U.S. and Canada found that being allowed to play a casual game for a few minutes before participating in training was a motivational hook that improved engagement” (Lawrence, 2018, p. 24).

Various solutions were developed with the use of gamification in training, for instance *Fitocracy* is an online training community that aims to use gamification to help users improve their fitness. Or *Yousician* is an online training app that help users to play an instrument using levels as the main game component to motivates students to engage (Polytechnic Institute of Santarem et al., 2018, The Listmusic Learning Apps, 2018). Also, examples of the use of gamification in OSH training already exist. Different examples are mentioned within this study. One of those, as example OSHA's Hazard Identification Training Tool presented by the United States Department of Labor (2014) - which was an interactive, online, game-based training tool for small business owners, workers and others interested in learning the core concepts of hazard identification.

In OSHA training module “Visual Inspection Training” which contains a saw, industrial chemical mixer, scaffolding and fall protection for inspection, users are tasked to recognize hazards on and around items they come across in the workplace. This, in turn, helps them to identify and classify typical hazard categories; and establish the relationship between workplace hazards and equipment components and operations.

The OSHA Visual Inspection Training Game Play gave an opportunity to the user to train themselves in the skill of visual inspection to find hazards. In this simulation, the user got a chance to have a 360° view of the equipment to trace and track possible hazardous scenarios. The user may also interact with employee and observe the trained employee, while at work, to recognise other risks. Once risks are recognised, the user checks the box in the log.

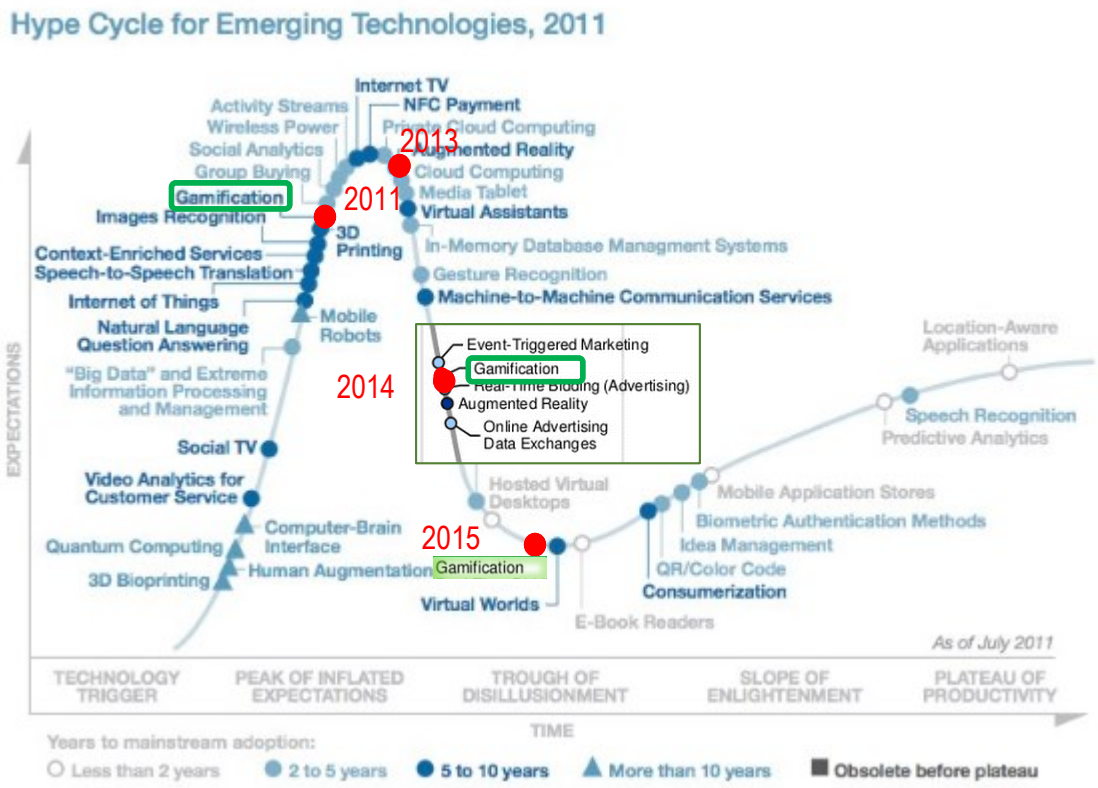
Although, the effects of gamification are still unclear even though it is commonly used in adult learning contexts.

5.2.2 Gamification – the focus segment and rationale behind implementation

In 2011 *Gartner* updated their previous analysis on the hype cycle of various areas in technology to include gamification. (Figure 5.) The hype cycle tracks new technologies from the time of their initial appearance in research through media coverage, criticism, productivity and maturity cycles. Gamification, according to *Gartner*, is already in the "trough of disillusionment". They further (2018) elaborate this as impatience for results begins to replace the original excitement about potential value. Problems with performance, slower-than-expected adoption or a failure to deliver financial returns in the time anticipated all lead to missed expectations, and disillusionment sets in.

In 2015, Gamification was not in the list of Gartner hype cycle of emerging technologies but appeared in Gartner's Digital Marketing hype cycle. Thus, Gamification started to be seen as a more common tool of product advertising, and customer engagement around this type.

Figure 5. The Gamification Hype Cycle Gartner Hype Cycle, (2011, 2013, 2014, 2015, 2019)



What is most interesting is that “there is only a 5% adoption rate by the time the product hits the slope of enlightenment” (O'Leary, 2008, p. 6). This translates to a promising future where growth is perceivable and will be on expected line.

Case studies have further helped to evaluate the potential of gamification, and an emerging understanding of its success has increasingly taken shape.

6 METHODOLOGY

Objective and research question

The objective of the research is to develop an understanding about the possible efficacy of gamification in OSH training, in Latvian context.

The research questions of the study are:

1. What are the factors influencing OSH training in Latvia from the perspective of trainers and workers?
2. How can Gamification influence OSH training scenario in Latvia?

The study is designed to ask and resolve the research question by the means of data collection and data analysis.

Data collection would rely on two input sources:

- Established data, both textual and numerical, that would be extracted from legacy records, recent record reviews, publications, literary or research works etc.
- Data from novel sources, both textual and numerical, that would be extracted from interviews with OSH workers and instructors

Data analysis would rely on two analytical models:

Cohort analysis – this is a quantitative analysis to figure out about how the participants from different organizations within the same industry would respond to the common questionnaire, which is designed to capture various nature of inputs.

Sentiment Analysis – this is a qualitative analysis to figure out about how the participants and interviewee respond to question that seek answer in varied forms to detect emotions (like anger, satisfaction, unhappiness, excitement etc.) and run an aspect/opinion based sentiment evaluation (“this new draft of OSH regulation law is very promising” etc) at the same time.

These, together, would be used to uncover insights into the experience and understanding of the respondents by using multiple data points.

Data Collection method

An OSH Industry-oriented approach would be adopted to filter the collected data using two methods:

- comparative study
- "induction and deduction"

Comparative analysis was chosen as a method to study both the commonalties and diversities of data pertaining to the OSH domain and to rationalize their significance as input to develop the applicability of gamification in OSH trainings.

"Induction and deduction" was chosen as a method to seek the patterns in findings, and to quantify the data. This method will be used to collect and analyse the verified data that are received from multiple sources.

Processing of data from Established sources

For collection of both textual and numerical natures of data, the author would explore the theoretical aspects including

- gamification, corporate training using the adult learning methods aided by distance learning technology
- legacy information about primitive OSH training models, empirical evidence of experimental OSH modules used in trainings, and scholarly research works

Processing of data from Novel sources

Latvia currently has over 10000 registered companies that are active in the Construction and manufacturing domains. However, over 95% of those are either defunct or dormant, or bankrupt or simply insignificant in size to come under purview of this survey. About 108 companies of consistent order book and less rate of attrition were selected from the remaining 5% of the functional companies.

In this section, the author would analyse the contributory outcome of data, collected from direct interview and responses from OSH workers of functional Latvian companies, in form of response to a structured emailed questionnaire. The data was extracted, and statistical analysis was carried out for this purpose. The ultimate objective is to assess the awareness and use of gamification in OSH trainings in Latvian context.

As mentioned, data were collected through emailed questionnaire that was given to 27 Occupational Safety and Health Specialists and 172 workers that were chosen randomly from different heavy industrial and infra/construction companies in Latvia. One interview was conducted in person with the Head of the Labour Inspectorate, Government of Latvia.

To specify, 5 questions out of 22 were of qualitative nature and were used to extract information that would help assess the psychological impact of unsafe work environment and accident proneness of the respondents.

17 questions were of quantitative nature. Answers to those 17 questions contributed to the research by providing specific data which could be processed to derive information of both direct and inferential natures.

True sample size was determined using classic sample size formulae. Ninety-six percent of the respondents were categorized based on their hands-on experience, exposure, knowledge and expertise.

The questionnaires

For OSH specialists - OSH specialists were asked to answer 22 questions about their preference in training and the current training situation in the companies they worked.

The questionnaire was divided into five components each of which was providing the information on different themes related to overall OSH training.

1. Profile of the OSH specialist;
2. Profile of the company;
3. Questions on Occupational safety training procedure in the organisation;
4. Training methods used in the company;
5. Questions regarding employees.

One of the preliminary questions was to enquire about the number of employees in their company. This information was important to understand the regulatory framework, including both country-specific and organization-specific regulations, that are applicable for the given team size.

For workers – workers were asked to answer 7 questions. As a non-obligatory, non-compulsive, and online method of registering data, workers questionnaires had high success rates given the fact that it is extremely economical, doesn't obligate to divulge data that a participant doesn't wish to reveal, and maintained anonymity.

The questionnaire was divided into 3 components each of which was providing the information on related to their experience in OSH trainings.

1. Profile of the worker;
2. Profile of the workplace;
3. Questions on Occupational safety training procedure in the workplace, including
    a. training, knowledge transfer or skills testing methods they've experienced;
    b. their attitude towards OSH training and use of game elements in those;
    c. their wishes and preferences.

Data Accuracy

Adulteration of the collected data was considered using the following factors:

A. For OSH Specialists

- Confidence Level - 90%
- Shortlisted Companies - 108
- Margin of Error - 10%
- True Sample Size: 42 respondents

In case of the OSH specialists the margin of error was considered high, and the confidence level in the data provided was considered low as their voices were representational and their contribution to the survey were based on industry exposure and knowledge but not coming as a result of their everyday experiences.

B. For Workers

- Confidence Level - 99%
- Shortlisted Companies - 108
- Margin of Error -2%
- True Sample Size:106

In case of the workers the margin of error was considered extremely low, and the confidence level in the data provided was considered very high as they were rich on everyday experience and could relate to the threats and accidents in more personal way than OSH specialists.

However, it was considered that emotional quotient could be very high in the minds of some respondents given, say, their personal adverse experience at the workplace. Thus, number of respondents in this case was increased to 172, an increment of about 62% from the ideal sample size to avoid contaminated data influencing the analytical outcome.

Limitations

Typical limitations of the data, in terms of both validation and reliability, were taken into consideration while the final sets of data were extracted for quantitative and qualitative analysis.

In case of quantitative analysis, the author observed the following limitations that could potentially influence the analytical outcome:

- Inadequacy in number of sources that the data were collected from (some of the legacy government data, including literature, are classified);
- Questionable depth in industry-based surveys that were widely used to refer for data;
- Overfitting, i.e., analysing some data more than necessary and underfitting, i.e., sample size too with respect to the size of the industry;
- Difficulty to homogenize the input data because of wide range of variables at source e.g. two workers might answer YES to a question “do you prefer lecture over training with game elements?”, but the reasons can be entirely different. Thus, the answer YES, in this case, is a bad/ignorable data. Such difficulty to homogenize data impedes the degree of accuracy.

In case of qualitative analysis, the author observed the following limitations that could potentially influence the analytical outcome:

- complex greedy algorithms to follow for a step-by-step analysis to extract the data;
- lack of both expertise and knowledge of data analysis to optimize data extraction;
- chance of higher degree of redundance in data due to the inability to control the environment. This would be a challenge at the time when qualitative legacy data would be calibrated.

7 FINDINGS OR RESULTS

7.1 Demand of available free modern methods for OSH trainings

In order to understand the Latvian scenario of OSH trainings, an interview was held with the OSH specialist who heads the Cooperation and Development Unit at State Labour Inspectorate in Latvia. Responses from the Specialist suggest that the two main sources of methods/tools to use for OSH trainings in Latvia are www.stradavesels.lv and the youtube channel of the State Labour Inspectorate (not mentioning Focal point of European Agency for Safety and Health - osha.lv, as its focus is to obtain and share news about legislation and events' itineraries, documents, and statistics). This information reflects the scenario in the field of labour protection in Latvia. Publications and additional information are mainly available in English).

The website: stradavesels.lv *(eng. work healthy)*
Created in cooperation with the Institute of Occupational safety and Environmental Health and State Labour Inspectorate, Govt of Latvia in 2009, this website was initially operated as a blog. Subsequently, in 2014, www.stradavesels.lv was converted to a full functioning website providing information on labour protection issues, and organizing educative events like seminars, and discussion forums.

In the first year of its revamp in 2014, this website had 22048 visitors in total. The number of visitors grew steadily over the years and in 2019 the website clocked 62291 visitors, thus hitting a total of 222035 views since 2014. (Table 4.).

Table 4. Statistic of main source webpage with information on labour protection issue (Source: State Labour Inspection)

ACCRUAL BASED ACCOUNTING

	Start of operation	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Stradavesels.lv	In 2009. year as a blog						
The number of visitors		22048	23820	35705	48859	59262	62291
Number of views		66428	75679	156832	195741	219260	222035

Time spent	in 2014. year as webpage	2:22	3:10	4:02	3:36	3:10	2:54

Several interactive tools were embedded since its inception as a webpage. Two of them were created in 2014, and last one – *open Test "Ruler" for multiply tries* in December 2015

- Risk game "Recognize the dangers"
- Test/quiz tool "LINEAL" (*Ruler*, in English),
- Accident calculator

In the Table 5. it can be seen that the biggest interest among the visitors of OSH interactive educational tools lies in the UX of the interactive tool "Risk game "Recognize the dangers", with total number of 99425 attempts over 5 years, since 2015. This game contained images where a visitor is encouraged to attempt solving a picture puzzle and/or responding to interactive image-based knowledge tests of hazards at workplaces. Being one of visual nature, this test emerged as a popular gaming tool for standard training.

Table 5. Statistic on interactive educational tools provided for free by government (Source: State Labour Inspection) Data on 1st Jan of 2020

ACCRUAL BASED ACCOUNTING

	Start of operation	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Accident calculator Number of uses	2014. year	252	451	594	701	1042	1272
Risk game "Recognize the dangers"	2014. year						
Number of images		84	90	117	123	156	157
Number of attempts		x	21310	40991	56965	77311	99425
Increase compared to last year			x	19681	15974	20346	22114
Share/proportion of found answers (%)		x	85.41	81.75	76.33	73.6	72.2
			on 31.03.2016.				
Test/quiz tool "Ruler"	2015. gads						
Number of tests		**x**	**x**	17	24	26	27
Number of attempts		**x**	**x**	3544	7763	12500	19123

Increase compared to last year		**x**	**x**	x	4219	4737	6623
Share/proportion of correct answers (%)		**x**	**x**	60.35	53.42	54.96	51.57

The next most used interactive tool is test/quiz tool "Ruler", where users have a choice of various topics. The tests can be taken in interactive form online, or can be printed to solve offline.
The author was also interested to find which exact themes were the most in demand. This was to understand which type of users used this tool more.

To achieve this goal, the author looked into statistics gathered from the internal database from the State Labour Inspectorate (provided on request by the Head of State Labour Inspectorate) (Table 6). It can be seen that the most popular tests pertain to: **1. Fire safety 2. Electrical safety and 3. Safety signs**. These subjects should be taught in every industry and that explains their popularity. But within these 3 subjects out of top 10 most used tests, the Electrical safety has the highest number of incorrect answers resulting into a worrying figure of 51% of candidates actually passing the test. This, statistically, left a risk of more than 1000 people possibly encountering accidents if they didn't learn from their mistakes.

Table 6. Statistic on Number of attempts of Test "Ruler" since 2016.y. Source: STI. Retrieved on 28th of April

Name	**Attempts**	**Proportion of correct answers**	**The date of creation**
Traffic routes and movement	5	54%	21.04.2020
Selection of protective clothing and work gloves	39	58%	01.04.2020
Truth or Lie - for victims of accidents at work who do not have an employment contract	173	68%	27.02.2020
Pregnancy and work	1606	51%	08.07.2019
Resign! (*atkrāpies!*)	1185	66%	22.05.2018
Annual paid leave (vacation, furlough)	1626	59%	12.01.2018
Occupational skin diseases	556	55%	20.08.2017
2. Electrical safety	2286	**51%**	12.06.2017
Electromagnetic fields	382	47%	13.04.2017
Work indoors	463	42%	12.04.2017

Asbestos in the work environment	236	57%	03.03.2017
Indoor microclimate and ventilation	1205	46%	02.12.2016
Early signs of occupational diseases	808	46%	30.11.2016
1. Fire safety	2348	56%	19.09.2016
3. Safety signs	1802	55%	21.07.2016
Compulsory and mandatory medical examinations	1428	49%	04.06.2016
Construction	542	56%	06.05.2016
Accidents at work and their investigation	923	52%	20.04.2016
Biological risk factors	515	47%	13.03.2016
Carcinogens in the work environment	324	44%	03.04.2016
Retail	446	55%	26.12.2015
Agriculture	630	50%	25.12.2015
Dust	622	46%	26.12.2015
Car repair	450	51%	22.12.2015
Risks of slipping, entrapment and tripping and their prevention	628	62%	21.12.2015
Noise and hearing impairment	433	51%	21.12.2015
Metalworking	294	58%	18.12.2015
Woodworking	432	51%	18.12.2015
Chemicals and their mixtures	733	56%	17.12.2015

Free Video archives

In Latvia, there are two video archives on labour safety training that are freely accessible to the public:

Source 1 – The youtube channel of State Labour Inspectorate. By the end of 2019, its archive had 143 videos.

Source 2 - The cloud storage of failiem.lv that is managed by Riga Stradina University (RSU) – by the end of 2019 had 107 videos.

The videos from the RSU archive are the same as those on the Youtube channel of STI.

Over one hundred thousand new views were generated in 2019 and 48 new videos that can be used as learning material were created. The number of views and number of videos of STI youtube channel are displayed in Table 7.

Table 7. State Labour Inspectorate youtube channel statistic - (Source: State Labour Inspection)

ACCRUAL BASED ACCOUNTING

	Start of operation	2014	2015	2016	2017	2018	2019
YouTube (STI)	2010. year						
Video number		43	56	67	77	95	143
Views		28179	39244	65134	84293	106991	276,649

7.2 Occupational Safety and Health trainings from the perspective of OSH specialist/trainer

The second source of data was a questionnaire with responses from Occupational Safety and Health Specialists in Latvia. It was considered important to accommodate their views, as well as their experience, since their perspectives are considered critical for a detailed understanding of implementing innovative teaching methods through gamification in the field of Occupational Safety and Health. 27 OSH specialists responded to the questionnaire.

Eighty-nine percent of respondents were the OSH specialists who come from organizations that have more than 50 employees. Nevertheless, response from all OSH specialists were differently considered and taken into account in cases where the questions had no correlation with the number of employees in the organization.

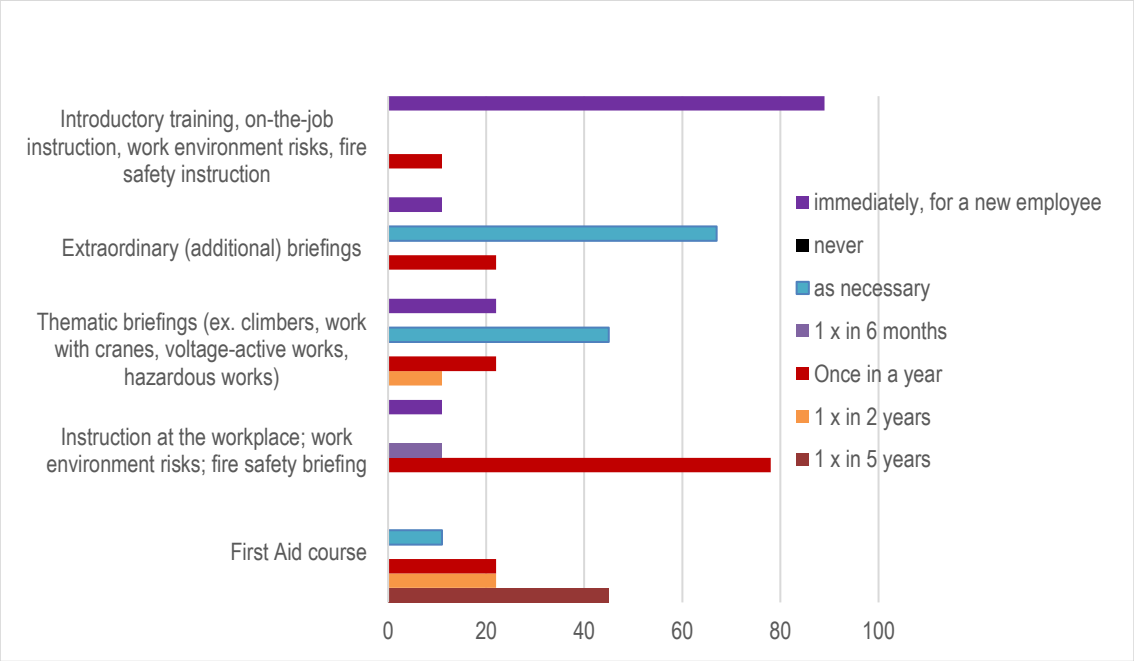
Under the third section of the questionnaire titled *OSH training in the company* the question *"Training. Please indicate the name and frequency of training/s in your company"* was asked. Response data were curated to aid to the greater understanding of the organization specific OSH training scenario in Latvia.

Figure 6. shows that the most common training cycle was once in a year and these mandatory training sessions covered the following subjects:

- Instruction at the workplace
- Work environment risks

- Fire safety briefing.

Figure 6. The type and frequency of OSH training/s in organizations (%)

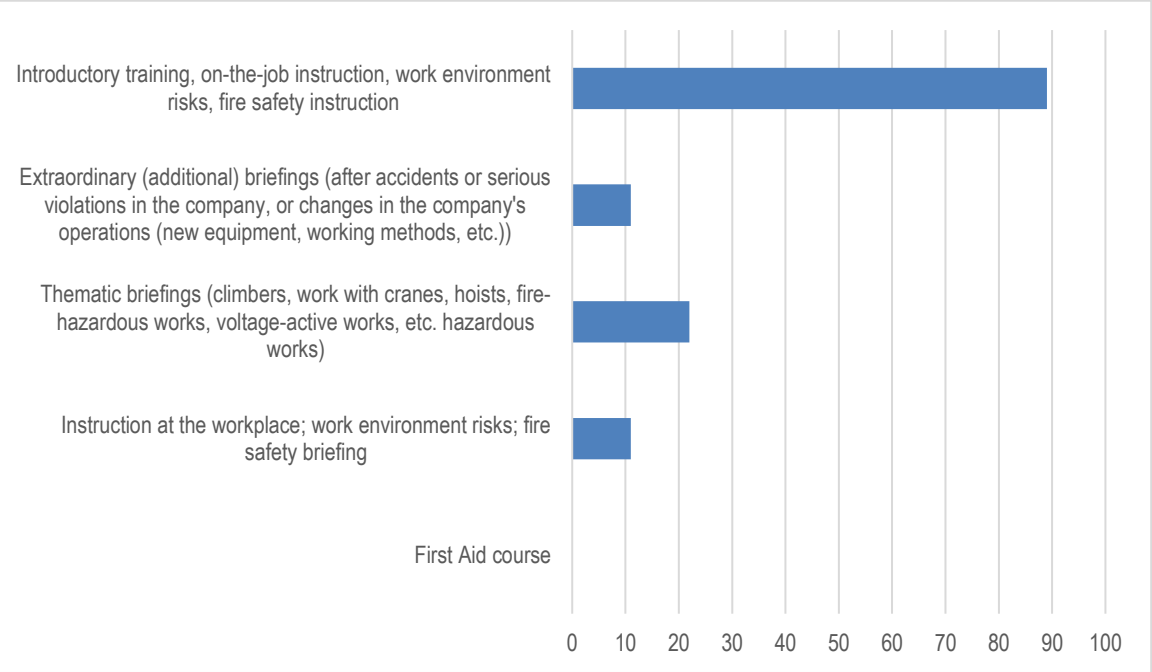


These training sessions were covered by workers from varied employment types, i.e., newcomers, part-timers, employees with both short and long work-hours.

As it can be seen on the Figure 7, there are 4 types of trainings that the companies are providing for the newly recruited workers. The questions were in format of multiply answers.

- Introductory training – 89%;
- Thematic briefings – 22%;
- Instruction at the workplace – 11%;
- Extraordinary (additional) – 11%.

Figure 7. The types of trainings that the companies are providing for the newly recruited workers (%)



In order to explore the applicability of these types of training in-depth, further studies would be needed to be made by incorporating statistics of current labour turnout with the statistical assumption on future turnout.

The question "*Do you think that is enough for safe work or is something missing?"* was not a mandatory question and received only 9 responses. More often, in different text variations, it appeared that daily monitoring and training are indeed required, as well as a reminder of OSH requirements.

Examples of responses included the following:

Respondent Nr. OS3 "Violations and non-compliance with OSH requirements in the company are needed more often to be discussed with employees";

Respondent Nr. OS4 "Daily monitoring and training required";

Respondent Nr. OS7 "There is a lack in quality instructional and training videos which can be recalled easily".

The responses helped to understand the views of OSH specialists about the organisation/company training system that they were using at their workplaces.

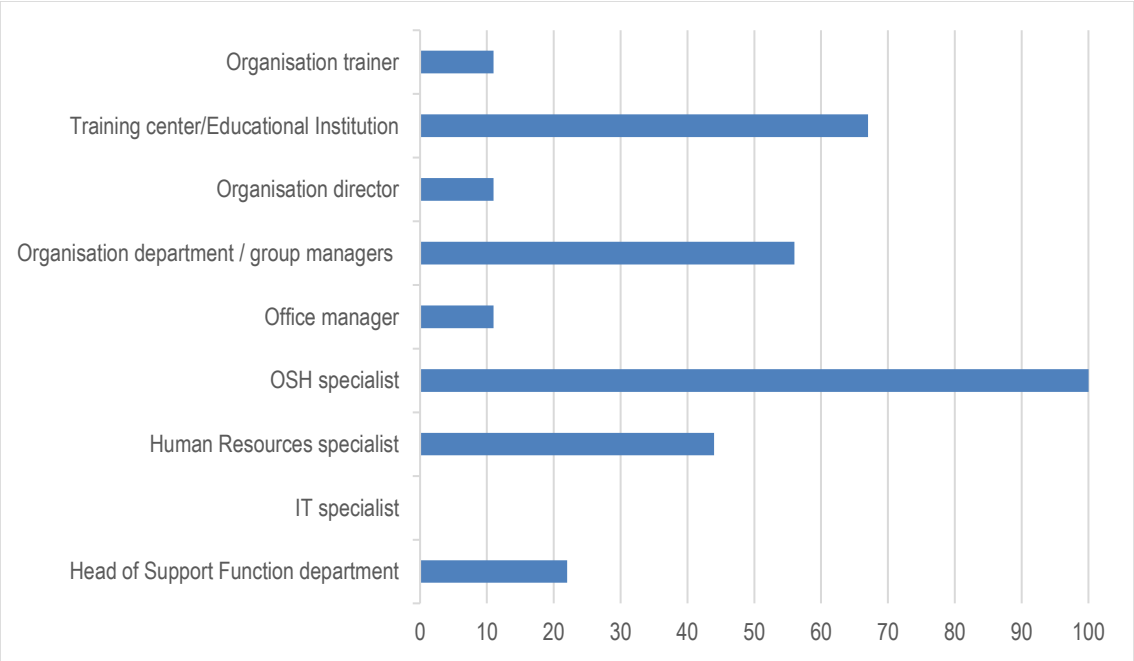
The fourth round of questions were about training methods. It was significant to know about who supervised the training. According to the law, companies are not obliged to send their employees to undergo the training in educational institutions. But in practice, majority of the employees were undergoing training in certified educational institutions. That, in turn, was resulting in to a lack of understanding by the companies about the quanta of knowledge acquired by their employees through those trainings.

Subsequently, the question of "*Which persons / parties are involved in the training process*" helped to understand about how many people were involved in the process, who needed to overview the process and the outcome of the training. It would also help to assess

a. If there was a need to add some elements in the training to ensure involvement and engagement of all the parties;
b. If yes, which were those elements.

According to data outlined in Figure 8, Health and Safety Specialists, in all companies, were engaged in providing training, whereas at 67% the vocational training centres/Educational Institutions played the most significant role in imparting training.

Figure 8. Persons/parties that are involved in the training process (%)



In several organisations multiple departments such as Human Resources, Logistics, etc. come to contribute to outlining the organization-specific training. They are engaged more for overviewing and managing organisational process than for trainings process itself. Although, in this case when 67% of organisations are sending their workers to educational institutions, no data is in the hands of all involved parties, except the certificate received from Educational Institution, demonstrating that they indeed underwent the training and finished it meaningfully. Neither the improvement in knowledge post training nor other parameters pertaining to the training would be known to different departments of the employer once the worker is considered trained.

Instead of asking a direct question about whether or not they use digital tools within organisation, the author framed the query in the form of multiple choices, where 'digital tools' was one of the choices.

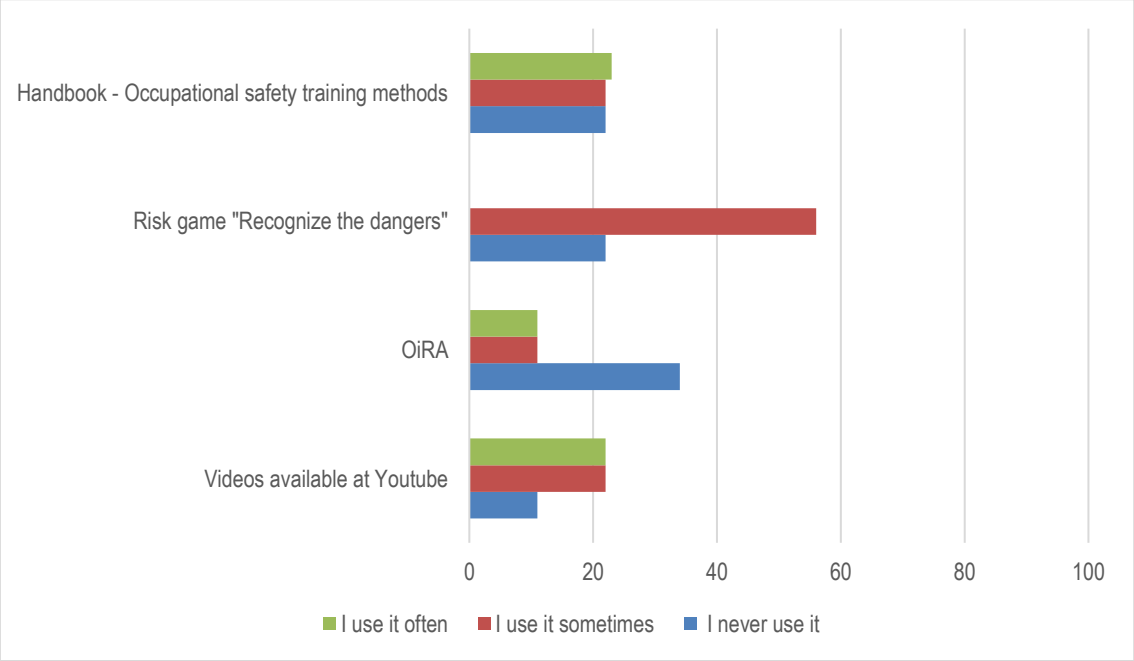
The question "*Do you use digital tools developed by the State Labour Inspectorate and RSU for employee training purposes?"* was included with the intention to understand the preparedness of the OSH trainers or the Main Trainers for distance learning. For a reference, depending on the system in the company, OSH specialists often play the role of trainers as they are the ones who evaluate all the risks in the company and therefore could provide the most structured information

to the employees. Even when the companies are sending their employees to educational institutions, OSH specialists are usually the ones who decide, on behalf of the candidates, about who needs what kind of training, and how frequently.

According to data outlined in Figure 9, the most frequently used but not the most **often** used training, is an online risk game named *Recognize the dangers* to detect hazards. It is the interactive game that most of the Latvian OSH workers have. Fifty-six percent of the respondents replied to be using it from time-to time. It has images of real worksites with hazardous situations shown in those. The trainee should click on those parts of the images where safety breaches can be seen. This game is easily accessible, doesn't require a registration process to go thru, and is engaging.

The most frequently used teaching tools, mentioned by OSH specialists as "I use it often", are the videos available at Youtube and Handbook – Occupational safety training methods.

Figure 9. The use of available digital tools developed by State Labour Inspectorate and RSU (%)

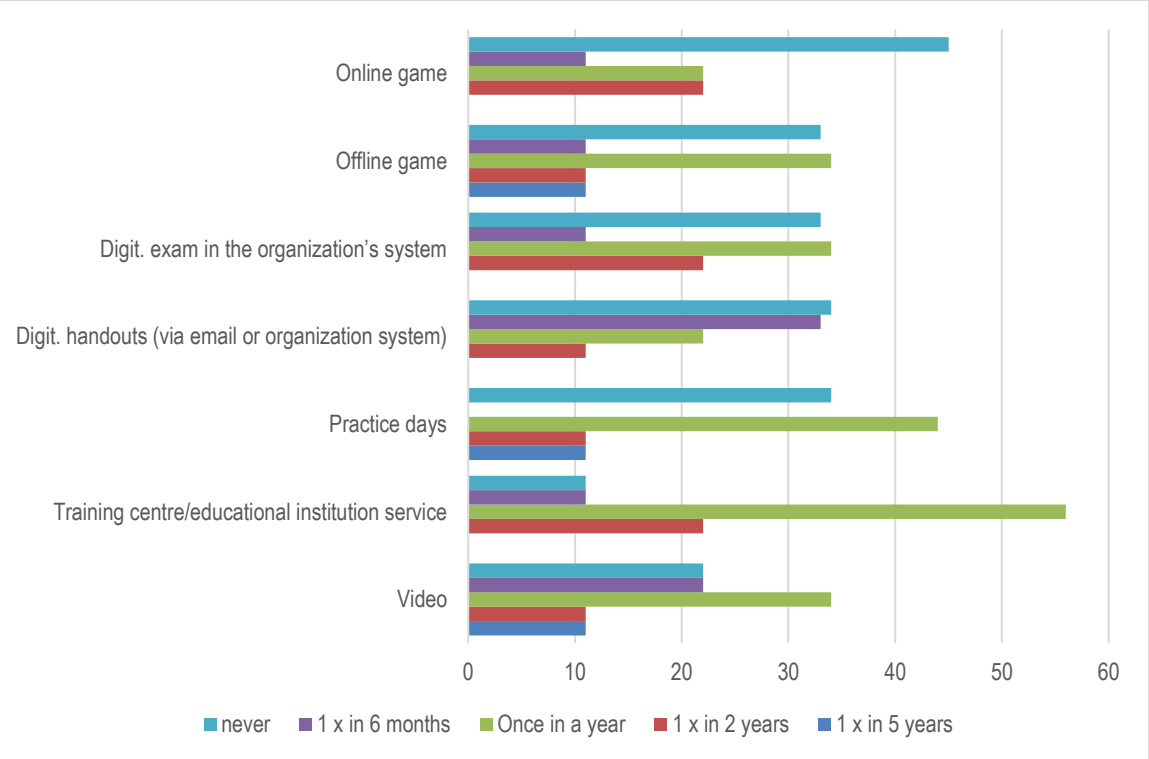


The least used digital tools by OSH specialists are OiRA, Labour protection knowledge test/quiz "Ruler" and Accident calculator. Thirty-four percent of OSH specialists said that never use those.

Occupational Safety and Health specialists for worker training use protection knowledge test/quiz "Ruler" maximum once in a year. The author allowed to assume that it was partly so, because it was promoted and seen more as a testing tool and was quite not recognized as a learning tool. Among other teaching methods that are currently in use, respondents Nr. OS3 and Nr. OS9 also mentioned "Employee survey" and "dialogues".

The question *"Which method/s skills testing do you use, and how often?" (Figure 10.)* found that 26% of respondents within their organisation, never used online games, and 22% have never used offline games for training. This, in turn, indicated that 74-78% of the participants were open to or were already using game-elements in their organisations.

Figure 10. The use of methods of knowledge transfer, knowledge and skills testing (%)



The author had to understand the preparedness of OSH specialists to adopt alternative interactive methods like gamification into their OSH training ecosystem. As mentioned in the earlier part of this work, the work culture is a value that deeply matters, and it doesn't just change from country to country, but changes from company to company as well. Therefore, the questionnaire results

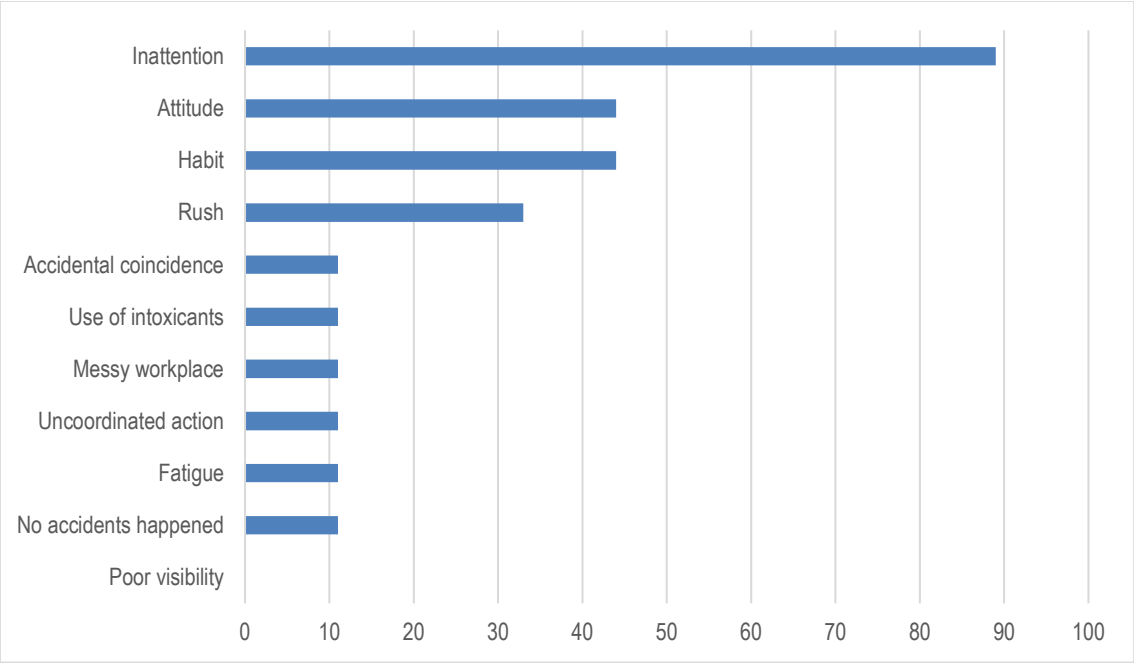
support the view that respondents already use games in trainings. The majority of the answers were positive including the following direct quotations relating to the use of games:
Respondent Nr. OS2 "Very good",
Respondent Nr. OS5 "Positive",
Respondent Nr. OS6 "can be used sometimes",
Respondent Nr. OS14 "I support",
Respondent Nr. OS17 "It is needed. Also, it may raise the interest of employees towards the training process".

To make the statement stronger about readiness of OSH specialists in Latvia to adapt and/or use distance learning, an additional question was framed. In question number 6, OSH specialists were asked *whether or not they used distance learning in their companies.* Eighty-one percent of respondents have answered, that they have not used distance learning. A question to find out the reason behind such low use of distance learning was not included in the questionnaire. Teaching online is used almost in every educational institution and there is part of training about legislation and requirements, that can be addressed individually.

The author asked OSH specialists about the OSH incidents that happened in the past and the reasons behind those. In the earlier part of this work, the author already mentioned that 68.1% of accidents in 2018 were caused by human errors. But that set of data was unclear about the reasons to which such accidents could be attributed to – to rushed and unorganized approach, to lack of attention, or to the substandard workplace condition. These could all be the reasons behind some of those accidents. The answers from the trainers helped the author to understand the deeper aspects of such incidents. The author could realize that an acquired knowledge pertaining to the underlying causes behind such accidents would help her choose the right game dynamics, mechanics and components to use in the training.

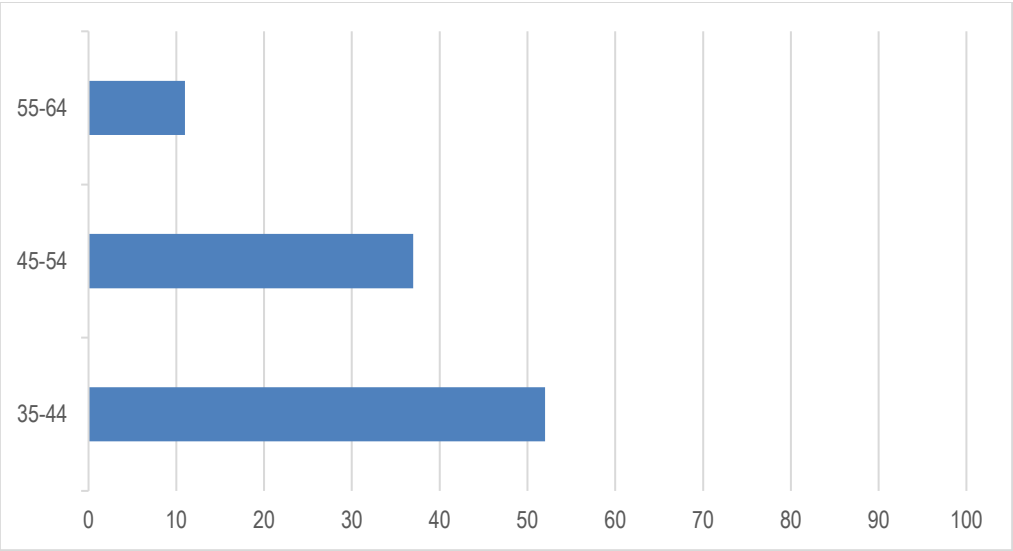
According to questionnaire data in Figure 11, the main factor of accidents is **inattention.** On the second place, where mentioned **habit and attitude** evenly shared the percentage of reasons – 44% each. This infers to what the emphasis should be on, and which of the issues should not be considered.

Figure 11. The causes of accidents (%) (from OSH specialist questionnaire)



The responses have showed that the majority of workers, who in turn were learners, are between 35 and 54 years old (Figure 12.). This information helps set a notion about what kind of digital tool will be effective for such target audience. It is assumed that the younger workers are more tech-savvy and can handle digital data more efficiently. But it should not be forgotten that 11% of workers, according to the responders, are older than 54 with the assumption that older workers will be less informed about and exposed to technology.

Figure 12. Average age of workers (%)



Overall, the author observes a lack of motivation to use technology, among respondents who were older workers, and is seen as a major impediment in implementing digitized education modules for OSH. This parallels the questionnaire results of 172 workers collected for this thesis work. The results are seen below.

7.3 OSH trainings from the perspective of workers

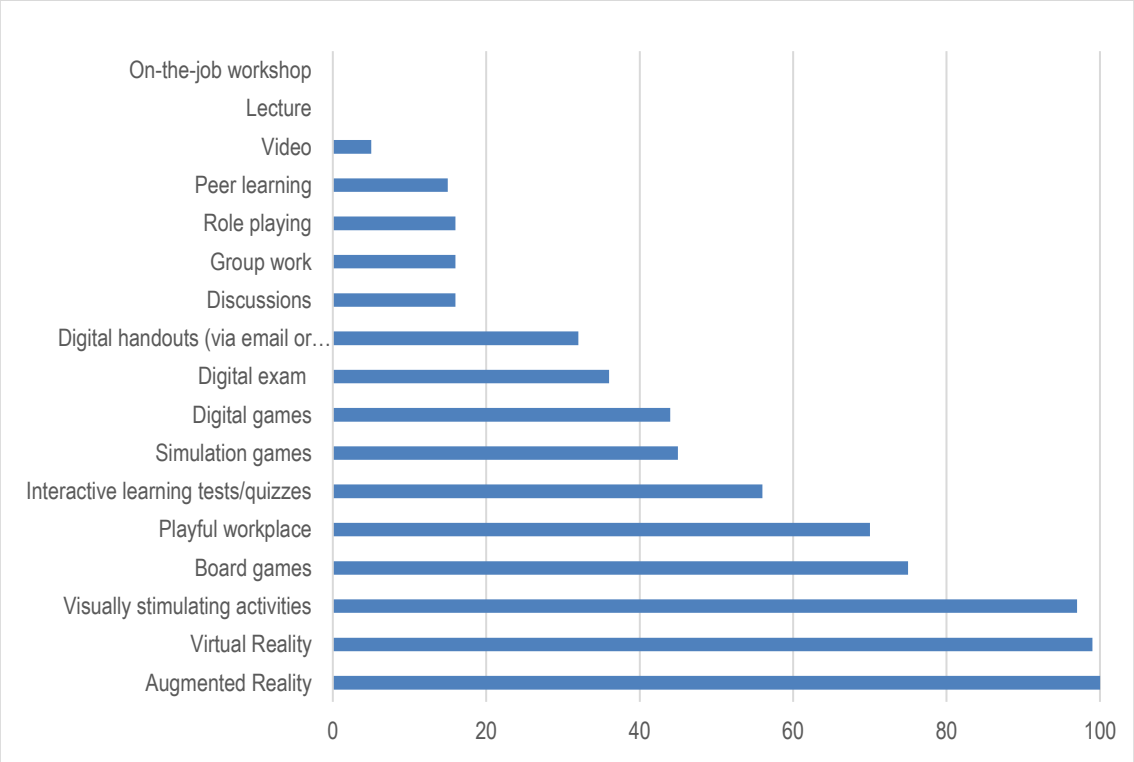
Workers' answers to the questionnaire have shown that 52% of workers are between 35 and 44 years old, 37% between 45 and 54 and the rest fall within the remaining 11%. Which shares the data of average age received from OSH specialists, that is between 35 and 54 years old. Ninety-eight percent of the respondents were males with varied work experience. Those with work experience between 6 and 10 years of work experience and 11 and 15 years of work experience shared the most votes. 6-10 years of work experience belong to 43% of respondents, 21% of respondents are with 11 to 15 years of work experience, 12% 2-5 years, 15% 16-25 years, 7% 26 and more, and least are with less than 1 year of experience, only 2%.
Most worker are from such industries as: manufacturing; construction; water supply, sewerage, waste and electricity.

Within the worker questionnaire 14% workers-respondents answered that they were undergoing trainings in certified educational institution, and 86% of them said that they go to certified educational institutions and also learn in within the company.

To know about which training methods/tools worker were familiar with and what was their attitude towards those, the author offered a list of those to choose from, as well as left a possibility to accommodate open answers, i.e., to accept any method that was not in the list. There were no other methods/tools mentioned by workers-respondents.

The most common used trainings that were experienced by workers were:
1. Lecture and On-the-job workshop 2. Video 3. Peer learning (Figure 13.)

Figure 13. Type of training or knowledge transfer method that were never used by workers (%)



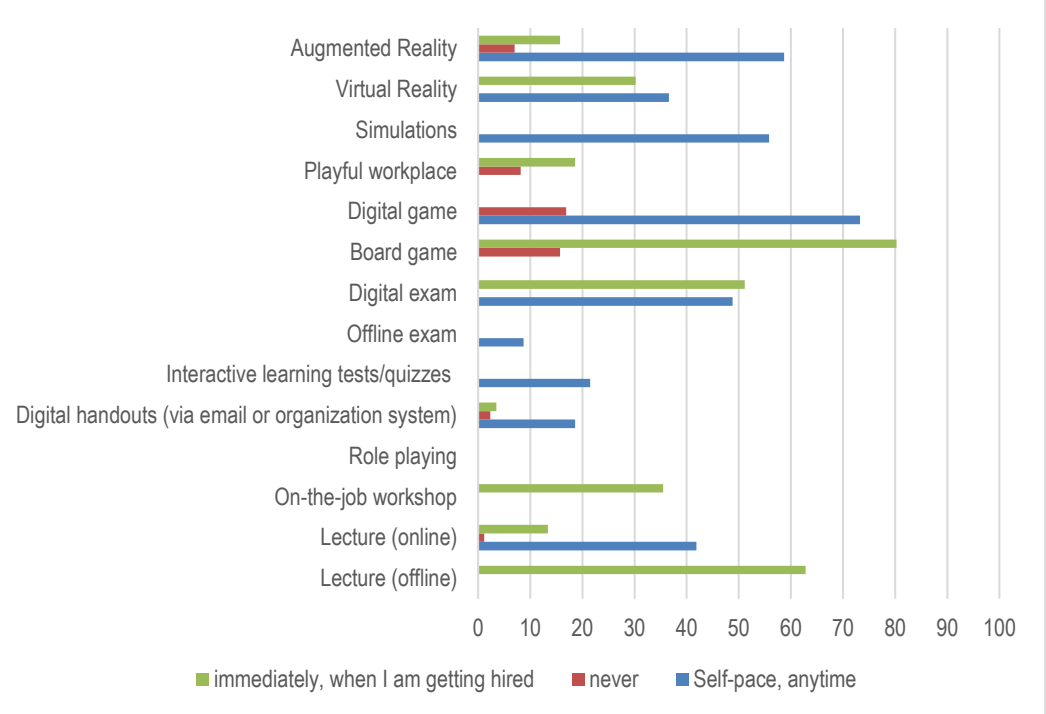
The digital methods were used by smaller percent of the workers comparing to classical approach. By classical approach the author means trainings and knowledge transfer methods that don't require additional equipment but trainer and worker, and are a part of trainings of majority companies in Latvia, such as Lecture, On-the-job workshop, Peer learning.

Fifty-six percent of workers at least once were trained with the help of digital games and 25% with the use of board games.

Further, the author was interested to see which kind of training the workers were willing to participate in. Such methods and tools can be used to boost their engagement and motivation. On the Figure 14 is seen that small percent of frequent training preference was given to games, in comparison with other choices, both offline and online. Also, according to results that are seen on previous Figure 13. less than 50% in average have experienced learning through games, therefore the majority opinion is based on assumptions than on experience.

The preferability of the workers about the type of OSH training changes depending on its frequency. For the trainings that will happen immediately when the worker is getting hired, 80% see board games as the best option for it at the same time 16% would never want to experience such type of training. Sixty-three percent prefer offline lecture, and 19% are keen to Playful workplace. The number of workers reach to 59% to experience such training once a year. (Figure 15.) Digital game is preferred by 73% at the self-pace time, while 17% would never want to play such games in relation to OSH trainings (Figure 14.).

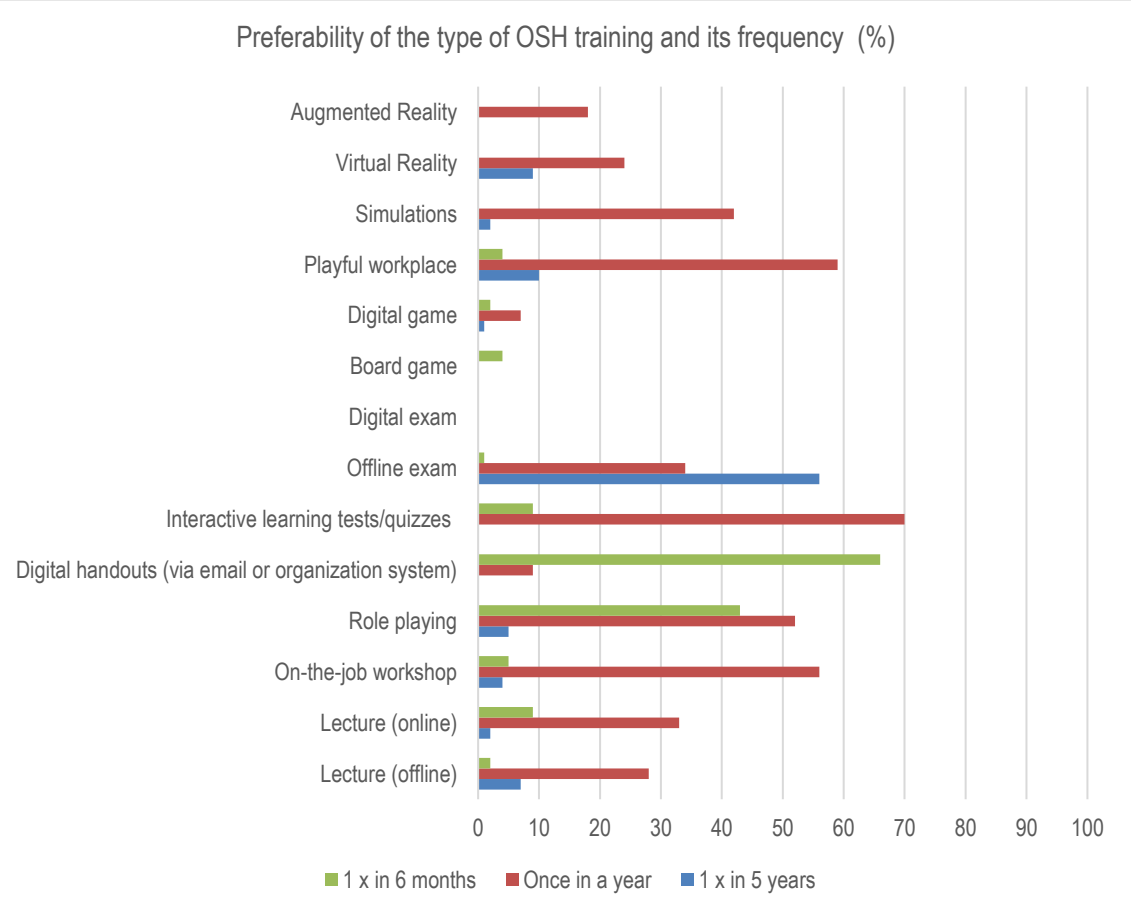
Figure 14. Preferability of the type of OSH training and its frequency by workers (%)



The most preferable type of OSH training for as often as once in a year are interactive learning tests/quizzes, chose by 70% of workers. After which are playful workplace and On-the-job workshop – 56 %. (Figure 15.)

Digital exam is preferred to be taken at the beginning of work -51%, when worker is being hired as well as self-pace – 49%. Offline exam, on the other hand, once in a year -34% and even more workers would like to go through it once in five years – 56%.

Figure 15. Preferability of the type of OSH training and its frequency from once in 6 months and more. (%)



The finding that the majority opinion about games is based on assumptions than on experience reflected in the response to the next question – "*What is your attitude towards the use of game elements in occupational safety training? (scale 1 to 5, where 1 is the lowest)",* Where only 23% where over mark 3 on scale, majority – 39% chose 3, and rest below.

7.4 Discussion section

A variety of requirements, promoted by the Latvian Occupational Safety and Health Focal Point of the European Organization for Safety and Health at Work in Latvia, specifically mandate organizations to educate and train their workers on the safety and health aspects of their work duties.

According to country regulations, the periodic training cycle of once a year is merely a suggestion and is not enforced by the Labour Authority as a law with penal clauses for non-adherence. This resulted in to a reluctant approach to these crucial requirements by the businesses. Obligatory instructions are given in a non-engaging way and fail to enthuse the workers.

The entire process reduces OSH training to something theoretical and statutory and passively dissuade the workers from attending trainings. It is important to emphasize that in Latvia, the motivation and awareness towards OSH trainings come largely from the employers and OSH experts within the company.

It is vital to ensure that all current and potential workers that are exposed to multiple risk factors receive sufficient and effective training in occupational health and safety. However, the training in Occupational Safety and Health is entrusted to mostly autonomous private institutions that are not governed by the state. The desynchronise and lack of centralization leads to complications in evaluating the results.

Workers preferability of the type of OSH training use of methods and tools varies, depending on the frequency and type of the training. This factor can be used by trainers to influence the engagement of the workers, by using the tool, that workers are keen to, while not losing the quality of the training. It is important to not oppose anything that relates to offline safety training, only trainers should also consider items that are specific to online/virtual safety training to raise the efficacy of the training.

7.4.1 Diversity of trainings

The views of OSH specialists and workers are a valuable source of information that should be taken into consideration in future training design. The OSH specialist questionnaire helped to detail a structured set of information about the readiness of the actual trainers, or the main trainer, in the fields of distance and digital training. Surely, only few standard methods were mentioned in the list to them, and therefore, it was offered to specialists to mention any other novel or alternate method/s that they were possibly using to train workers. (Appendix 2. Q. 14 and Q. 15),

Based on the responses received to the worker and OSH specialists' questionnaire, majority of the companies in Latvia use basic training model, largely consists of a series of lectures, to fulfil the legal requirements. It just helps to learn the bare essentials coupled with brief information on main OSH topics in the company. Even if the instruction of 1-2 hour once in a year action achieves working level understanding of the occupational risks at one workplace, this may not hold true for all industries.

All employees have an affirmative duty to comply and undergo the training - and most do comply proactively. However, not all employees feel that compelling motivation, which results into their reduced attention, and lack of knowledge of the occupational risks. Motivation and engagement is the key to OSH training of adults.

The author found it positive that the majority of workers answering the questionnaire have experience of more than 5 years. It might mean that they must have experienced varied kinds of trainings, and can evaluate its efficiency, as well as personal likes and dislikes are based on experience more than on expectations. This, in turn, brough in greater precision to the study, in particular to the first research question: What are the factors influencing OSH training in Latvia from the perspective of trainers and workers?
Although, according to the results of questionnaire, majority of opinion about learning through games is based on assumptions than on experience. Which is downsizing the reliability for the second research question: How can Gamification influence OSH training scenario in Latvia?

If OSH specialists had not been using any of the innovative methods that the author asked in previous questions then it was important to understand which OSH training methods, they found more adaptable in terms of applicability and efficacy. (Appendix 2. Q.17).

7.4.2 Games or trainings with game elements

Different kind of games – digital games, board games, simulation games, interactive learning quizzes did not find much of support within OSH specialists. In their views those are only moderately effective. Nevertheless, a lively workplace is characterized by majority as more effective than ineffective. Fifty nine percent of the workers found 'playful workplace' as a preferable type of training as frequent as once a year.

In overall the use of gamification in OSH training is welcomed by OSH specialists and has a potential for enhancing the trainings and make its effectiveness higher. It is also recommended to be combined alongside other interactive approaches. As, for example 70% of workers was willing to incorporate in OSH training once a year interactive learning tests/quizzes.

The controversial results are in relation to workers attitude towards OSH trainings with game elements. Within the scope of direct question regarding their attitude towards the use of game elements in OSH training, majority of workers were evaluating it as average. While, high percent of workers were choosing games or trainings with game elements over non gamified trainings: 80% of workers chose board games as the preferable type for the training when they are getting hired; Once in a year - playful workplace – 59%, Self-pace, anytime – Digital game – 73%.

7.4.3 Learning tools for OSH trainings

The most used learning tool in Latvia for OSH trainings been proven to be **videos**. The main source is STI youtube channel that is also duplicating OSH related videos located on failiem.lv.
The Director of RSU explained that many videos are repeating themselves failiem.lv vs youtube due to data protection. Failiem.lv – is Latvian equivalent to cloud storage space, like DropBox, OneDrive etc. Anyone could download from there. Some of the videos are protected by copyright law and were thus not allowed to be downloaded. Such videos could thus be located only on STI youtube channel. Hits were not very explored by the STI youtube channel, the author noticed that while to some purely instructional videos maximum amount of views were 3000+, the videos that reflected how serious injuries can be, ex. Stories of real people, of the accident with disturbing images inside had more than 11000 hits. All this information helped the author to understand the demand and interest of users

The most used interactive tool on stradavesels.lv - *Risk game "Recognize the dangers"* is time consuming, and there was no real information found to suggest that this was a proven, effective method for OSH training. But it cannot be denied that it can be good used as a reminder of the risks, which might be effective to raise the attention of the worker.

7.5 The design of OSH training with gamification

Every training process continuously evolves around methods, applications, and platforms. Concerning OSH training, a studied approach to maximize the efficacy of impartation of knowledge is what method is about. A scientific method needs application of enriched communication skill backed by intelligently designed content. And finally, the training would require a platform where methods and applications converge to integrate and create an innovative learning interface for the trainee.

The proposed framework for OSH training would base on four guiding principles:

P1: Elaborate analysis of the target group and context extraction using which the framework could be developed
P2: Defining the goals and objectives of OSH training with help of interactive tools or game elements.
P3: Defining the needs and goal of the users/company's workers, and those of the company from an OSH specialist perspective.
P4: Identifying Key Performance Indicators (KPIs)

7.5.1 Proposed framework: aspects and features

The target learners' groups comprise of majority of adults falling in the age bracket of 35-45 years. According to EU regulations, 'youth' lasts till 30 years of age and 54% of workers/respondents are aged above 35 years, while the remaining are divided between those who are older than 45 years of age, and those who are younger than 35 years of age.

The author has categorized the OSH training development in three stages. This is based on an OSH training model of the year 1979. This framework (Appendix nr. 5) intends to guide the implementation of new programmes, updating existing programmes, and engaging stakeholders in sustainable processes of design, implementation, and evaluation of distributive training initiatives. This framework is subjective and is based on the output of conducted questionnaires and on the findings from study literatures. A series of tests would be conducted to evaluate the efficacy,

flexibility, feasibility of the framework. During this process the requirement for corrective measures would also be considered.

The proposed evolvement of framework for gamification, from designing to testing, is constructed here in three subsequent stages.

Stage 1: Evaluation

Before choosing the appropriate training activities and their elements, one should answer the questions about the training needs and define its goals and objectives.

Table 8. Goals and objectives of the training

1. Determining if Training is Needed	Training is needed to reduce number of accidents
2. Identifying the extent of training needed	a) To comply with legislation b) To eliminate or minimise the risk for employee and to reduce accidents at the workplace. c) To raise the employee engagement in trainings
3. **Setting Goals and Objectives**	full compliance, positive behavioural change, continuous improvement, self-education

Upon evaluation of the input against query-centric questions based on the points mentioned above, a composite model of training would be structured. In the proposed model (Table 9.), the modularized training options have been suggested.

Table 9. Modularized training options

	Traditional /basic/ methods of OSH trainings	**Additional methods in few companies**	**Strategic model with gamification**
Aim	Legal compliance and prevention of	Eliminating or minimising the risk for	Providing timely and accurate OSH related

	occupational risks for workers Weinstein: full compliance, no improvement, average results	employee. Reduce accidents in the workplace. Weinstein: correct behaviour, results better than average	information - self-paced training Weinstein: continuous improvement, leadership, excellent results
Approach	- External OSH services - accordingly to the Latvian legislation - Theoretical periodic training of 1-2h. Weinstein: courses, instruction, checking	- Lecture at the workplace - 1 day dedicated to OSH - Hands-on training at the workplace Weinstein: instruction and support, positive competition	All year self-paced training Weinstein: good practices, examples, positive competition, self-education

Basic OSH trainings can exist without the additional methods but will largely fail to serve its intended purpose. The additional methods enable the basic trainings to explore their true capacity. And finally, the strategic model with gamification, as an additional tool, supports the traditional trainings in various ways.

Basic OSH training

Basic OSH training is the set of minimal requirements to comply with Safety Training legislation and Labour Laws (Table 9.) Historically, basic trainings have failed to improvise the quality of workplace safety awareness. Looking at the statistic, since 2015 till 2018 the amount of accidents has increased by 27% in places where basic training was provided. Thus, the author thinks that more measures should be taken.

Additional OSH trainings

Additional trainings such as shorter training frequency, shorter than once a year, are now being provided by several organizations. The goal is to keep workers constantly updated, aware and alert. Continuous control, and situation-based approach are among few other training concepts that organizations additionally undertake to ensure optimum OSH awareness and measures. Author has mentioned these in detail the chapter titled *Findings and Results.*

Strategic model involving gamification

The concept of Gamification can be incorporated into workplace learning culture on a self-paced schedule to make the training more effective and motivating among the workers. As results of the study showed – this concept received positive response from 73 percent of the respondents. The goal behind implementing this concept is to achieve continuous improvement of workplace safety ethics and a more meaningful engagement with the workers to ensure enhanced productivity by reducing hazard related adverse incidents.

The training modules suggested here are independent by nature and can be used separately or in connection with each other.

Stage 2: Selection

This stage is about developing learning activities and identifying elements.

In the second stage, according to training needs, the training design team should choose the activities that are most suitable for the trainees to attain the intended goal. Here, the author drew on the thinking and practices of training programs mentioned earlier in this work.

Throughout this phase, the OSH specialist/trainer should evaluate the choice of activity according to the objective of the training and the curriculum.

Table 10. The list of activities according to training needs

	Training need	Activity	Goal
1.	**To comply with legislation**	Lecture	Full compliance
2.	**To eliminate or minimise the risk for employee**	Lecture Hands-on training Discussions Group work Peer learning Digital materials Test	Correct behaviour, continuous improvement
3.	**To raise the employee engagement in trainings**	Video Simulation VR	Self-education

	Game-elements (ex. playful workplace, board games, playful workplace)	
	Visually stimulating activities (creating of mind maps, collages) Role playing Interactive learning tests/quizzes	Engagement

Stage 3: Synthesis

After OSH specialist/trainer chose the appropriate activity and conducts the training, he is required to evaluate the program's efficacy and improvise wherever needed. Such improvisation reflects critically on process during trainings, thus continuing the iterative cycle of data collection, evaluation and intervention.

Table 11. The program's evaluation

Activity	**Evaluation of the Program Effectiveness**	**Improving the Program**
Lecture	pre-test vs post-test	security, scalability, quality control, vulnerability assessment
Lecture; Hands-on training; Discussions; Group work; Peer learning; Digital materials; Test	pre-test vs post-test, digital test, completed hands-on task	
Video; Simulation; VR; Game-elements (ex. playful workplace, board games, playful workplace); Visually stimulating activities (creating of mind maps, collages); Role playing; Interactive learning tests/quizzes	self-efficacy, enjoyment, pre-test vs post-test	

7.5.2 Learning Model for "Fire Safety" training

Based on the findings of the study and the proposed OSH learning model and training framework, the author outlines here the learning model for Fire Safety training.

According to results, the most common training cycle was once in a year and these mandatory training sessions covered the following subjects: Instruction at the workplace, Work environment risks, **Fire safety briefing.** The most undertaken tests on www.*stradavesels.lv* are **1. Fire safety** 2. Electrical safety and 3. Safety signs, respectively. These three are core safety training subjects and are to be compulsorily taught about, in every industry.

Based on workers preferability of the type of OSH training and its frequency, several methods and tools were chosen: Interactive learning tests/quizzes, playful workplace and hands-on training.

Below is the Fire Safety training model, described in tabular form, where the principle activities and learning components are highlighted.

Table 12. Learning Model for "Fire Safety" training

<table>
<tr><td colspan="4">Stage 1</td><td colspan="2">Stage 2</td><td colspan="2">Stage 3</td></tr>
<tr><td>Nr.</td><td>Determining if Training is Needed</td><td>Identifying Training Needs</td><td>Identifying Goal and Objectives</td><td>Activity</td><td>Elements of Effectiveness</td><td>Evaluation of the Program Effectiveness and KPI milestones</td><td>Improving the Program</td></tr>
<tr><td>1</td><td colspan="7">Training is needed to reduce number of accidents.
During the research it was found that "Fire safety" trainings is the most frequently needed and is in search for new solutions in trainings to engage workers.</td></tr>
<tr><td>1.1</td><td rowspan="4"></td><td>a) To comply with legislation</td><td>Full compliance</td><td>Lecture</td><td></td><td rowspan="4">digital test, completed hands-on task, Self-efficacy, enjoyment</td><td rowspan="3">security, scalability, quality control, vulnerability assessment</td></tr>
<tr><td>1.2</td><td>b) To eliminate or minimise the risk for employee and to reduce accidents in the workplace.</td><td>Correct behaviour</td><td>Hands-on training</td><td></td></tr>
<tr><td>1.3</td><td rowspan="2">c) To raise the employee engagement in trainings</td><td rowspan="2">continues improvement, Self-education</td><td>Interactive learning tests/quizzes</td><td></td></tr>
<tr><td></td><td>playful workplace</td><td>design workplace with game-elements</td><td></td></tr>
</table>

7.6 Summery

In earlier sections the author has conducted a broad-spectrum analysis, shared her observation, and elaborated on key points such as

- Global OSH scenario;
- OSH scenario in Latvian context;
- History of OSH trainings in Latvia;
- Opinions of OSH personnel;
- Opportunities to embed newer technologies.

The findings from these have led to an understanding that there are influencing factors that can potentially facilitate implementation of newer technologies, including gamification, these are positive influencing factors. These are termed by the author as *positive factors*.
On the other hand, there are key factors that throw out challenges to the idea of a transition towards learning using novel methods like gamification. These are termed by the author as *negative factors*.

The table below displays the comparable factors, both positive and negative, by the degree of their influence across the OSH training domain.

Table 13. OSH training factors and their degree of influence.

OSH Training Factors		**Degree of Influence**
Positive Types	**Negative Types**	
Presence of basic OSH awareness across the industries	Archaic statutory laws & negligible government funding to promote awareness	Very High
Employers' awareness about the obvious benefits of following upgraded OSH norms	Lack of motivation among the workers to take OSH learning seriously	High
Availability of Academically eligible and adequate number of trainers	Lack of modernized OSH training facilities	Moderate

Excellent internet infrastructure to implement cutting-edge training methods	Lack of homogeneousness among trainees in terms of educational background, experience and exposure to adopt newer learning methods	Low

Degree of Influence: Very High.

Here the author observed that whilst the industry is well aware of the statutory requirement for OSH trainings and mostly obliging to those, the learning doesn't serve practical purposes of any kind very meaningfully as the technology and work environments have advanced since the time.

Degree of Influence: High

Next in line are the passive factors that have substantial influence on workplace safety. The author found that employers largely recognize the need for additional trainings, beyond the mandatory compliance training, to optimize productivity and minimize adverse OSH incidents, this is a very strong positive. However, workers have displayed reluctance to learn the advanced trainings seriously.

Degree of Influence: Moderate

The literacy rate of Latvia is high and so is the percentage of people who seek higher education. This is a great contributing factor in building a resource pool of able instructors. This is most certainly a positive. However, not many OSH training institutes, funded or not by the Government, are equipped with adequate resources to implement newer OSH training methods, this is seen by the author as an obvious negative.

Degree of influence: Low

Any newer technology would require internet connectivity to share data by means of cloud computing and here Latvia scores very high. This country boasts of a robust IT infrastructure and that's most certainly a positive. However, given the varied level of efficiency among workers, optimized use of the technology remains a challenge.

Currently the statutory training requirements for OSH training in Latvia are relatively obscure and are not uniformly applicable across the industries. The lack of newer approach and methodology, while taking into consideration the technological advancements of recent time, is weakening the involvement of the workers in the training process.

These are the key influencing factors that the author has found during the course of this work.

The response to this question has largely been derived from the findings of the previous question. The findings of the previous question regarding factors influencing OSH training in Latvia, can be contributing elements in the assessment of influence of gamification on OSH training (Table 13.)

The positive influences, as mentioned in Table 13. answer key queries like:

- Measurable objectives

Measurable objectives are largely the tangible targets like, reducing injuries by 50% or boost productivity by 30% etc.

Positive influencing factors mentioned in the table 13. offer key set of justification about why and how OSH industry in Latvia requires the transition and is ready for that.

- Nature of gamification to be adopted

Positive influences answer to this only partially. Positive influences offer a wide gamut of possibilities here, whereas negative influences are limiting factors in choosing the nature and design of the gamification.

The negative influences, as mentioned in Table 13. point at key limitations, are:

- Lack of visibility

As the Latvian OSH laws are old, the newer international standards and norms are to be used during designing.

This makes it very hard to tie it to the learning objective as the learning objective itself stays largely undefined.

- Lack of balance

Creating the right balance to ensure that entertainment and learning go hand in hand is greatly needed to retain gamification's attraction value. Gamification concept should be built with conviction

in its systems and representations – these are key for an adaptive gamification platform to create popularity and find growing acceptance among users. Creating such a gamification platform would be very challenging given lack of initial motivation among workers.

- Lack of trigger

The lack of homogeneousness in workers leads to a challenge which is of both commercial and technical nature. The gamification platform must be very adaptive to the skill level of the user and developing that kind of an intelligent platform is only feasible when the ROI is attractive. With no significant government funding and with limited fund allocation by corporates for OSH training, this remains a very big challenge till now.

The author assumes that the framework proposed in this work can be considered as a reference to:

- OSH educators in educational institutions – to improve existing programmes;
- OSH specialists in the workplace – to develop the training specifically for the needs of their company; to implement new and improve existing programmes;
- policy-makers – to create a local standard – for implementation, and evaluation of distributed training initiatives;
- OSH content developers – to recognize the importance of modernization of the teaching content;
- gaming app developers – to understand the rationale behind the importance of gamification of OSH trainings in Latvia.

From a broader perspective, this can be said that this framework would be a useful tool to raise the quality of OSH trainings in Latvia.

8 CONCLUSION

Here, the author likes to iterate the research questions and the objective which influenced this work. Those are:

1. *What are the factors influencing OSH training in Latvia from the perspective of trainers and workers?*
2. *How can Gamification influence OSH training scenario in Latvia?*

During research, several factors were found which negatively influence the process of training, as well as the level of engagement among the workers. Those are:

- outdated OSH compliance requirements and training guidelines set by governmental organizations;
- lack of uniformity in directives for the industries;
- lack of surveillance, monitoring;
- lack of synchronization of trainings;
- the mismatch between training expectations of the OSH workers and the type of OSH training that are advised and/or provided has negative effect on workforce motivation and confidence.

As well, as factors which influence positively the process of training. Those are:

- presence of basic OSH awareness across the industries;
- employers' awareness about the obvious benefits of following upgraded OSH norms;
- availability of Academically eligible and adequate number of trainers;
- excellent internet infrastructure to implement cutting-edge training methods.

Gamification can reasonably be considered as the next step forward, in terms of learning methods. It can also be seen as a transition or a crossover from traditional to modern method of learning, Nevertheless, justifications are required to be reasoned.

This work will provide a deeper, unbiased insight into the OSH industry in Latvia and can lay the ground for further research and design of a gamification framework by taking inputs from this work.

The outcome of this current work is also expected to stay relevant to existing and future OSH specialists who may refer this to create OSH training content with gamification elements in the corporate learning environment, specifically in Latvia.

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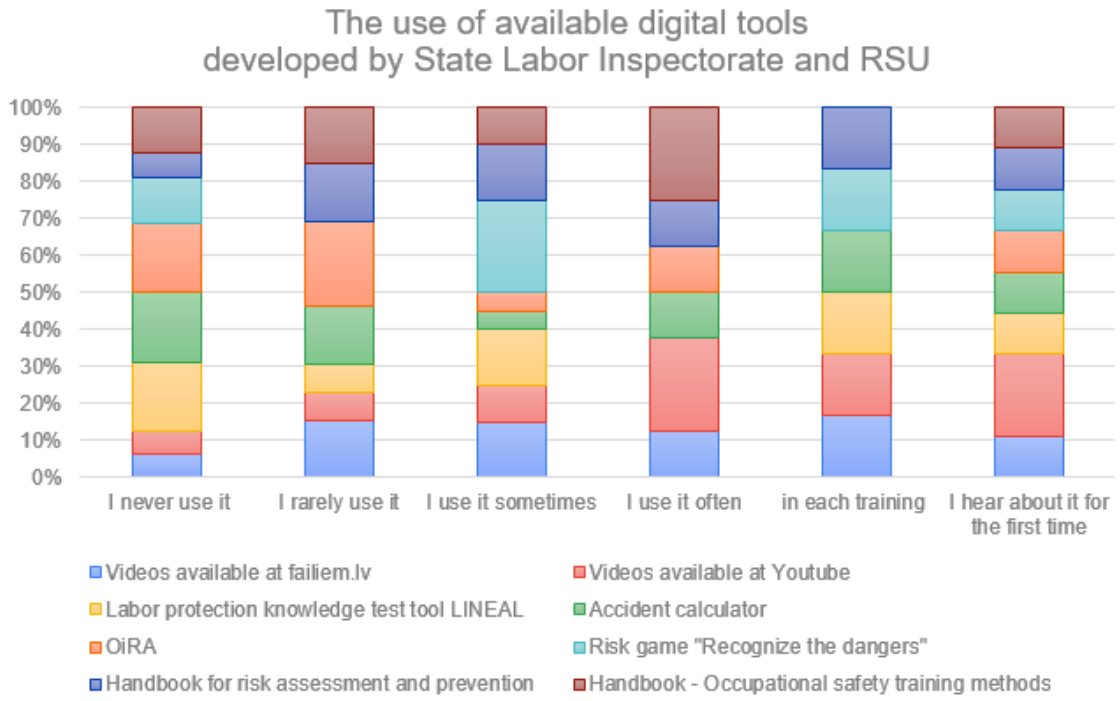
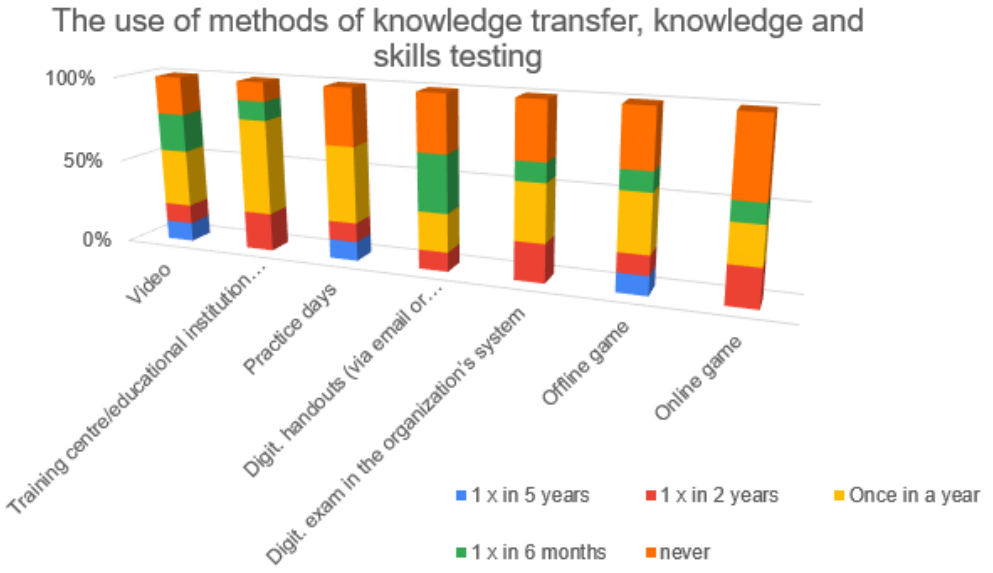
APPENDICES

APPENDIX 1	THE EXPERIENCE AND PREFERENCES OF WORKERS
APPENDIX 2	QUESTIONNAIRE FOR AN OCCUPATIONAL SAFETY AND HEALTH SPECIALIST
APPENDIX 3	QUESTIONNAIRE FOR A WORKER
APPENDIX 4	INTERVIEW WITH OSH EXPERT –LINDA MATISANE VDI
APPENDIX 5	FINAL GOAL-DRIVEN OSH LEARNING MODEL AND FRAMEWORK


The use of available digital tools developed by State Labor Inspectorate and RSU
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
I never use it
I rarely use it
I use it sometimes
I use it often
in each training
I hear about it for the first time
Videos available at failiem.lv
Videos available at Youtube
Labor protection knowledge test tool LINEAL
Accident calculator
OiRA
Risk game "Recognize the dangers"
Handbook for risk assessment and prevention
Handbook - Occupational safety training methods


The use of methods of knowledge transfer, knowledge and skills testing
100%
50%
0%
Video
Training centre/educational institution...
Practice days
Digit. handouts (via email or...
Digit. exam in the organization's system
Offline game
Online game
1 x in 5 years
1 x in 2 years
Once in a year
1 x in 6 months
never

QUESTIONNAIRE FOR AN OCCUPATIONAL APPENDIX 2

SAFETY AND HEALTH SPECIALIST

Hello, my name is Marianna, I am a student at the Oulu University of Applied Sciences (Oamk), Finland. Currently, as part of my academic research work, I am conducting a study that aims to find out what tools and educational methods should be included in labour protection trainings in Latvia in order to increase their efficacy.
Questionnaire filling time is about 10-12 minutes.
The participant remains anonymous. No personal data collected.
Thanks in advance for your participation!
In case of questions and/or comments, please contact me by e-mail to m8lima00@students.oamk.fi

Section 1.

*1.***Sex**

- ☐ Male
- ☐ Female
- ☐ Other

1. Age

- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65+

2. Work experience

- ☐ up to 1 year
- ☐ 2-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-25 years
- ☐ 26+

Section 2. Profile of the company

3. Number of employees in the organization

- ☐ 1-5
- ☐ 6-10
- ☐ 11-20
- ☐ 21-30
- ☐ 31-50
- ☐ 51+

4. Industry

- ☐ Agriculture, forestry and fishing
- ☐ Mining and quarrying
- ☐ Manufacturing
- ☐ Electricity, gas, STEM and Air conditioning supply
- ☐ Water supply; sewerage, waste management and remediation activities
- ☐ Construction
- ☐ Wholesale and retail trade
- ☐ Repair of motor vehicles and motorcycles
- ☐ Transport and storage
- ☐ Accommodation and food service activities
- ☐ Information and communication
- ☐ Financial and insurance activities
- ☐ Real estate activities
- ☐ Professional, scientific and technical activities
- ☐ Administrative and support service
- ☐ Public administration and defence
- ☐ Compulsory social insurance
- ☐ Education
- ☐ Human health and social work activities
- ☐ Arts, entertainment and recreation
- ☐ Other

Section 3. OSH training in the company/organization

Questions on Occupational safety training procedure for employees in your organization

5. System:

- ☐ according to the plan (according to the schedule)
- ☐ after the conclusion of a OSH specialist, looking at the situation.

6. Organization of the training:

- ☐ Planned 1-2 years upfront
- ☐ Planned 3-5 years upfront
- ☐ Planned 3-6 months upfront
- ☐ Not planned
- ☐ Other:_____

7. Please indicate the name and frequency of training/s in your organization

	1 x in 5 years	1 x in 2 years	Once in a year	1 x in 6 months	as necessary	never	immediately, for a new employee that is going to be hired
First Aid course	☐	☐	☐	☐	☐	☐	
Instruction at the workplace; work environment risks; fire safety briefing	☐	☐	☐	☐	☐	☐	
Thematic briefings (climbers, work with cranes, hoists, fire-hazardous works, voltage-	☐	☐	☐	☐	☐	☐	

active works, etc. hazardous works)						
Extraordinary (additional) briefings (after accidents or serious violations in the company, or changes in the company's operations (new equipment, working methods, etc.))	☐	☐	☐	☐	☐	☐
Introductory training, on-the-job instruction, work environment risks, fire safety instruction	☐	☐	☐	☐	☐	☐

8. **Please mention other trainings that take place in your company, that were not mentioned above**

_____

_____

_____

_____

9. **Do you think that is enough for safe work, or is something missing?**

_____

_____

_____

Section 4. Training methods

10. **Please specify:**

- ☐ Employees are undergoing training in certified educational institutions
- ☐ Employees are undergoing training within the company
- ☐ Employees are not trained until the inspection of the Labour Inspectorate arrives
- ☐ Other _____

11. **Which persons / parties are involved in the training process:**

- ☐ Head of Support Function department
- ☐ IT specialist
- ☐ Human Resources specialist
- ☐ OSH specialist
- ☐ Office manager
- ☐ Company department / group managers
- ☐ Company director

- ☐ Training center/Educational Institution
- ☐ Other_____

12. Do you use digital tools developed by the State Labour Inspectorate and RSU for employee training purposes? (1- I never use it 2- I rarely use it 3 - I use it sometimes 4 - I use it very often 5- in each training 0 - I hear about it for the first time)

	1	2	3	4	5	0
Videos available at failiem.lv	☐	☐	☐	☐	☐	☐
Videos available at Youtube	☐	☐	☐	☐	☐	☐
Labour protection knowledge test tool LINEAL (Ruler)	☐	☐	☐	☐	☐	☐
Accident calculator	☐	☐	☐	☐	☐	☐
OiRA	☐	☐	☐	☐	☐	☐
Risk game "Recognize the dangers"	☐	☐	☐	☐	☐	☐
Handbook for risk assessment and prevention	☐	☐	☐	☐	☐	☐
Handbook - Occupational safety training methods	☐	☐	☐	☐	☐	☐
I do not train / instruct employees, it is done by another employee / training center	☐	☐	☐	☐	☐	☐

13. What methods of knowledge transfer, knowledge and skills testing do you use (and how often)?

	1 x in 5 years	Once in a year	1 x in 6 months	as necessary	never	immediately, for a new employee that is going to be hired
Video	☐	☐	☐	☐	☐	☐
Training centre/educational institution service	☐	☐	☐	☐	☐	☐
Practice days	☐	☐	☐	☐	☐	☐
Digit. handouts (via email or organization system)	☐	☐	☐	☐	☐	☐

Digit. exam in the organization's system	☐	☐	☐	☐	☐	☐
Offline game	☐	☐	☐	☐	☐	☐
Online game	☐	☐	☐	☐	☐	☐

14. Please mention other methods and how often you use them in your company

_____

_____

_____

15. What is your attitude towards the use of game elements in occupational safety training?

_____

_____

_____

16. Please, evaluate which in your opinion modern training methods are the most effective for acquiring knowledge about occupational safety for employees.
(1 - ineffective, 2- more ineffective than effective, 3 - moderately effective, 4- more effective than ineffective, 5 - effective, 0- not used / participated)

	1	2	3	4	5	0
Simulation games	☐	☐	☐	☐	☐	☐
Virtual Reality/Augm. Reality	☐	☐	☐	☐	☐	☐
Digital games	☐	☐	☐	☐	☐	☐
Board games	☐	☐	☐	☐	☐	☐
Discussions	☐	☐	☐	☐	☐	☐
Interactive learning tests/quizzes	☐	☐	☐	☐	☐	☐
Group work	☐	☐	☐	☐	☐	☐
Role playing	☐	☐	☐	☐	☐	☐
Peer learning	☐	☐	☐	☐	☐	☐
Visually stimulating activities (creating of mind maps, collages)	☐	☐	☐	☐	☐	☐
Playful workplace (internal competition and nomination are also elements of the game)	☐	☐	☐	☐	☐	☐

On-the-job workshop	☐	☐	☐	☐	☐	☐

Section 5. Employees

17. What is the average age of your employees?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

18. Do employees comply with labour protection requirements? What is their attitude towards occupational safety and health (OSH), OSH training?

_____

_____

_____

19. Had there been any accident in your company in the last 3 years? If so, could that be prevented if the employee/s had been better informed?

_____

_____

_____

20. If accidents have occurred, what were their causes:

- No accidents happened
- Rush
- Habit
- Attitude
- Fatigue
- Inattention
- Poor visibility
- Uncoordinated action
- Messy workplace
- Use of intoxicants
- Other _____

21. Does your company practice distance learning?

- Yes

- No
- Other _____

Thank you for your time and honest answers!

Please provide your e-mail so that I, Marianna, can contact you in case I need clarifications of answers. _____

QUESTIONNAIRE FOR A WORKER APPENDIX 3

Hello, my name is Marianna, I am a student at the Oulu University of Applied Sciences (Oamk), Finland. Currently, as part of my academic research work, I am conducting a study that aims to find out what tools and educational methods should be included in labour protection trainings in Latvia in order to increase their efficacy.
Questionnaire filling time is about 10-12 minutes.
The participient remains anonymous. No personal data collected.
Thanks in advance for your participation!
In case of questions and/or comments, please contact me by e-mail to m8lima00@students.oamk.fi

Section 1. Persona

1. Sex
- ☐ Male
- ☐ Female
- ☐ Other

2. Age
- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65+

3. Work experience
- ☐ up to 1 year
- ☐ 2-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-25 years
- ☐ 26+

Section 2. Profile of the workplace

4. Your work position

_____

5. What is the industry you are working in?
- ☐ Agriculture, forestry and fishing
- ☐ Mining and quarrying
- ☐ Manufacturing
- ☐ Electricity, gas, STEM and Air conditioning supply
- ☐ Water supply; sewerage, waste management and remediation activities
- ☐ Construction
- ☐ Wholesale and retail trade
- ☐ Repair of motor vehicles and motorcycles
- ☐ Transport and storage
- ☐ Accommodation and food service activities
- ☐ Information and communication
- ☐ Financial and insurance activities
- ☐ Real estate activities
- ☐ Professional, scientific and technical activities
- ☐ Administrative and support service
- ☐ Public administration and defence
- ☐ Compulsory social insurance
- ☐ Education
- ☐ Human health and social work activities
- ☐ Arts, entertainment and recreation
- ☐ Other

Section 3. Training methods

1. **Please specify where you are undergoing OSH trainings:**
   - ☐ undergoing training in certified educational institutions
   - ☐ undergoing training within the company
   - ☐ both
   - ☐ Other _____

2. **Which kind of training, knowledge transfer or skills testing methods you've experienced and how satisfied you are of those** (1 – not satisfied, 2- more not satisfied than satisfied, 3 - moderately satisfied, 4- more satisfied than not satisfied, 5 - satisfied, 0- not used)

	1	2	3	4	5	0
Simulation games	☐	☐	☐	☐	☐	☐
Virtual Reality	☐	☐	☐	☐	☐	☐
Augmented Reality	☐	☐	☐	☐	☐	☐
Digital games	☐	☐	☐	☐	☐	☐
Board games	☐	☐	☐	☐	☐	☐
Discussions	☐	☐	☐	☐	☐	☐
Interactive learning tests/quizzes	☐	☐	☐	☐	☐	☐
Group work	☐	☐	☐	☐	☐	☐
Role playing	☐	☐	☐	☐	☐	☐
Peer learning	☐	☐	☐	☐	☐	☐
Lecture	☐	☐	☐	☐	☐	☐
Visually stimulating activities (creating of mind maps, collages)	☐	☐	☐	☐	☐	☐
Digital handouts (via email or organization system)	☐	☐	☐	☐	☐	☐
Digital exam	☐	☐	☐	☐	☐	☐
Video	☐	☐	☐	☐	☐	☐
On-the-job workshop	☐	☐	☐	☐	☐	☐
Playful workplace (internal competition and nomination are also elements of the game)	☐	☐	☐	☐	☐	☐

3. **Please mention other methods that were not mentioned before**

_____

_____

_____

4. Please indicate the frequency and type of OSH training that is preferable for you

	1 x in 5 years	Once in a year	1 x in 6 months	Self-pace, anytime	never	immediately, when I am getting hired
Lecture (offline)	☐	☐	☐	☐	☐	☐
Lecture (online)	☐	☐	☐	☐	☐	☐
On-the-job workshop	☐	☐	☐	☐	☐	☐
Role playing						
Digital handouts (via email or organization system)	☐	☐	☐	☐	☐	☐
Interactive learning tests/quizzes (CSDD type - for reference)	☐	☐	☐	☐	☐	☐
Offline exam	☐	☐	☐	☐	☐	☐
Digital exam	☐	☐	☐	☐	☐	☐
Board game	☐	☐	☐	☐	☐	☐
Digital game	☐	☐	☐	☐	☐	☐
Playful workplace (internal competition and nomination are also elements of the game)	☐	☐	☐	☐	☐	☐
Simulations	☐	☐	☐	☐	☐	☐
Virtual Reality	☐	☒	☐	☐	☐	☐
Augmented Reality	☐	☐	☐	☐	☐	☐

5. What is your attitude towards the use of game elements in occupational safety training? (scale 1 to 5, where 1 is the lowest)

1	2	3	4	5
☐	☐	☐	☐	☐

6. Do you comply with labour protection requirements? What is your attitude towards occupational safety and health (OSH), OSH training?

_____

_____

_____

7. **Does your company practice distance learning?**

- ☐ Yes
- ☐ No
- ☐ Other _____

Thank you for your time and honest answers!

Please provide your e-mail so that I, Marianna, can contact you in case I need clarifications of answers. _____

INTERVIEW WITH OSH EXPERT –LINDA MATISANE VDI APPENDIX 4

1. **How long have you been working on occupational safety and health issues?**
   About 20 years
2. **What do you think are important to take into account in training for personnel on health and safety, at work?**

To my experience and understanding, I'd say that it's a combination of

- Careful selection of training topics, Setting the purpose with clarity and unambiguity irrespective of whether it's about learning something new or revisions of what's taught and learnt, pre-arranged training, employee structure, experience, other companies' experience (both in terms of accidents and other issues related to the work environment and training methods) and several other aspects.

3. **What training methods do you think companies should use to educate employees about health and safety at work? Does it change according to the number of trainees in the organization / industry?**

Different methods under different circumstances. There is no The method that works for everyone. The number of employees and the industry are of vital consideration, because companies are characterized by different work organization (for example, large companies tend to have divisions / structural units / branches located throughout Latvia), but in construction and forestry majority of the employees are not working offsite. It is therefore important to have a knowledge of the aforementioned aspects in order to choose the most appropriate working methods. Also important are the resources available - both financial and time - for small businesses it will always be less than for large ones.

4. **What is your opinion on modern training methods in the field of labour protection? (Eg simulation games, digital games, board games, discussions, interactive training tests / quizzes, playful workplace)**

All methods are useful in specific situations. For example, simulation games are very good for simulating emergency situations. This helps to learn how to give first aid in the event of an accident. Discussions are suitable for seminars, for attitude change training, tests – to evaluate the knowledge, quizzes for labour protection days or sports games where the concept of safety is one prime aspect.

There will also be situations where the specific tools will not work, such as in the case of social care centre staffs where it's difficult to image the effectiveness of digital play for. The most important

thing for each employer is to evaluate the most appropriate method, the goal should be taken into account and the profiling of employees should be done with higher precision.

5. **What per your opinion are the problems in the field of labour protection and safety training in Latvia?**

Rigid formalities. Written instructions that require you to read them and sign the instruction log.

6. **In your opinion, are there any challenges / obstacles to the application of gamification elements in occupational safety and health training? If so, what are they?**

Public maturity ("real men don't watch cartoons and don't play games")

Lack of creative people among labour protection specialists

Reluctance to do more than required, by the State Labour Inspectorate.

7. **How do you rate the labour protection training in Latvian companies in general? Can you indicate what improvements would be needed to continue the successful work (successful DA training)?**

As with the whole labour protection situation, training has all 50 shades of gray, from black companies that do nothing (they have no training, often employ workers illegally) to white (creative / innovative methods every year) - both monopoly and bingo, both tests and simulation games with interesting scenarios). I think we need to continue to share good practices in different ways. I think this is the most effective solution. And then public authorities need to set an example, for example by creatively developing www.stradavesels.lv, from which entrepreneurs / organizations can be inspired (for example, several companies have supplemented their knowledge tests with the option "Read more, find the answer", similar to Ruler and Risk game - say ahead).

FINAL GOAL-DRIVEN OSH LEARNING MODEL AND FRAMEWORK APPENDIX 5

Stage 1				Stage 2		Stage 3	
Nr.	**Determining if Training is Needed**	**Identifying Training Needs**	**Identifying Goal and Objectives***	**Activity***	**Elements of Effectiveness**	**Evaluation of the Program Effectiveness and KPI milestones**	**Improving the Program**
1	Training is needed to reduce number of accidents						
1.1.		**a) To comply with legislation**	Full compliance, average results	Lecture		pre-test vs post-test	security, scalability, quality control, vulnerability assessment
1.2.		**b) To eliminate or minimise the risk for employee and to reduce accidents in the workplace.**	Correct behaviour, continuous improvement results better than average	Lecture; Hands-on training; Discussions; Group work; Peer learning; Digital materials; Test		pre-test vs post-test, digital test, completed hands-on task	
1.3		**c) To raise the employee engagement in trainings**	continues improvement, Self-education, excellent results	Visually stimulating activities (creating of mind maps, collages); Video; Role playing; Interactive learning tests/quizzes			
				Simulation; VR**		Self-efficacy, enjoyment, pre-test vs post-test	
				Game***	game design game dynamics behavioral economic motivational psychology ROI-driving business implementations Neurobiology	technology platforms UX/UI (user Experience and User Interface	

Adapted from:

* Weinstein 1997

** Mayer et al. 2019

*** Yu-kai Chou 2015

The essential component on each phase - curriculum