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Aviation Industry Resilience through Game Based Training and Reskilling

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Game-based training and serious games can be found among a great variety of sectors and industries including the aviation industry. They represent the huge shift from traditional instructor training methods to game-based in the market nowadays.

In a world of unprecedented change and multiple effects of the Covid-19 pandemic, the global economy is facing rapid changes in the way products and services are being delivered. New trends and methods are applied and are evolved day by day. In order to develop a sophisticated game-based training system, it is important to take into consideration the current situation, and also the technical and pedagogical aspects of games for the trainees.

Game-based learning is an interesting method that applies to multiple fields. Games in general are highly motivational, which is an aspect often missing in traditional computer-based training methods. From the software perspective, artificial intelligence and simulations have great potential in the training methods.

Gamification

Nowadays, gamification is defined as “the use of game design elements in non-game contexts” (Deterding et al. 2011, p. 9). Gamification is a term used to describe the application of typical elements of game playing to enhance systems, services, organizations, and activities. Its purpose is to create similar or even identical experiences for the user while playing to motivate and engage them. It can be defined as a group of activities and processes to solve problems by the game element application.

It has become a common method applied in employee training and scientific research regarding it, has deepened. It was firstly considered to be a hype associated with the marketing strategy, in 2013. As the hype has subsided and gamification has drawn the attention of academics and professionals of various fields, such as health, education, information studies, military. Although it has drawn much attention and empirical work, the effects remain uncertain.

It is a common misunderstanding that everything game relating in the training process is characterized as gamification. Gamification includes game elements to existing methods in order to achieve a desirable goal or result. Its purpose is to enhance a training outcome when the existing methods have failed to. To do so, it challenges the users to learn, to make effort and change.

The backbone of gamification lies, when something does not seem to deliver results in the training and is ineffective, then a solution needs to be found via gamification. Gamification is the most preferable way amongst others. Though game elements are included that target more positive learning outcomes, that does not necessarily lead to a success. For instance, people can be motivated to take a shift in their behavior under the circumstance that the game elements

used, points, badges, have a meaning for them. If not, then the game elements have no use for them and their training.

Gamification & Serious Games

Gamification has to be distinguished from games and serious games, though they might have similarities. Games can be defined as "voluntary activity, obviously separate from real life, creating an imaginary world that may or may not have any relation to real life and that absorbs the player's full attention" (Michael & Chen, 2005, p. 8). Its purpose is entertainment, and they are rules to be followed.

On the other hand, serious games, educational games also known as games for learning focus on education. Entertainment is not a key aspect. They are applied in multiple sectors including military, healthcare, education, government, but also business (Garris, Ahlers & Driskell, 2002). It is an experience designed using game mechanics and game thinking. What both games and serious games have in common is that they can both be categorized as instructional methods where users/players are taught a particular skill or knowledge and also they incorporate game elements to improve the learning outcomes.

Now that games and serious games have been explained, we can compare them to gamification. Gamification is not just an instructional method, but an instructional design process, the process of incorporating game design elements to non-game contexts (Deterding, Dixon, Khaled & Nacke, 2011), that is applied to already existing methods, in order to enhance the target outcomes. In a nutshell, a user cannot learn from gamification, but improve existing learning.

Research & Practice

The application of gamification in the learning process does not have a step-by-step guide. In each case the most efficient case scenario differs. Game elements are involved in the training method. As examined (Armostrong and Landers, 2017), the addition of game elements in the training process, while keeping the rest of the context identical and untouched, can bring significant more positive outcomes such as increased training satisfaction. This confirms the fact that points, badges upon level completion can provide the trainee with the status, knowledge and satisfaction needed in order to interfere with the system. There is a risk worth mentioning though; the game elements must be carefully added or it may have a negative impact on the trainees if viewed for instance as manipulative or forced.

Research and practice regarding gamification highlight the use of points, badges, and leaderboards. A desirable behavior results in an award. Its roots lie in the Psychological Learning Theory in which good behaviors are rewarded. The Psychological Theory will be further explained and examined in the next chapters. Trainees can also be motivated by the leaderboard and the place they stand when compared to others. All in all, the elements abovementioned are attempts to motivate them to learn.

Upon literature review by Dicheva et al. (2015), 34 different studies about gamification in education and the various learning contexts, have been examined. The conclusion was, game elements do have a positive outcome in engagement and participation of the trainees while learning. Another interesting finding was the comparison among gamified learning and other learning systems in which the authors leaned on the gamified learning.

Studies followed have verified the same outcomes; the positive correlation between game elements and learning. The game elements examined so far included points, leaderboards, and badges, but there are many more other that need further examination. Some of them worth mentioning are challenge, narrative and immersion. It was Landers (et al. 2017a) who did the majority of the analysis and concluded the reasons behind the effectiveness of these game elements in learning contexts. Challenge can be used in goal-setting theory (Locke & Latham, 2013) in which the goal must be of the appropriate level of difficulty; not too easy not too difficult. Narrative texts are most preferable used in comparison to other kinds of texts (Graesser, 1980). Lastly, immersive game elements emphasize the psychological fidelity in the training process. The first conclusion among these game elements is positive especially when combined with points, badges and leaderboards.

Effective methods of Gamify Training

When gamified training is chosen as the best approach for employee training, the designers must treat its design similar to other redesigned training methods and follow the ADDIE model (Goldstein, 1980). ADDIE stands for Assessment, Design, Develop, Implement and Evaluate. The ADDIE Instructional Design (ID) method is practically a framework in the design and the educational development.

It is a model widely accepted and used. It is based on the Five Step Approach model, developed by the U.S. Air Force. The ADDIE model kept the basic five-step feature, but also included other features within each of these steps. Its steps are clarified and that makes them preferable for the designers. The steps though do not have to be followed with the above sequence in a hierarchical structure. That makes the model interactive and also dynamic.

The phase of the analysis can be paralyzed as the goal-setting stage. The designer targets the audience, levels and skills are paired with the trainees. In addition, a background analysis has to be done, the goals, objectives of the training have to be determined and also existing methods, strategies have to be examined in order to improve them and redesign them. The reason behind the analysis step, it is to determine the knowledge the trainees already have and what they should learn during their training and upon its completion.

The phase of design is the stage in which goals, tools, objectives are determined. Following a systematic approach and specific rules, each element shall be examined in depth. Every single detail matters and aligns to the chosen strategy. It includes the determination of the different types of media that will be used, the resources required, the time frame of each activity, the

knowledge and skill that each task develops, the feedback mechanism and also the training activity.

The design follows the development in which the production and testing begins. The collected data is used with the intend to create a training program base on true needs. Development is the action, the drafting, the production and the evaluation.

The implementation phase is all about modifying the program and reassuring maximum efficiency and best results. Designers redesign, update, modify the program so as to further improve it. They get feedback from the participants-trainees. The consistent analysis, modification and improvement of the program makes sure its effectiveness. Designers have to monitor it at every step and evaluate it. Different game strategies will have to be matched with a variety of types of learning content in order to create the proper learning outcome.

Lastly, evaluation plays a crucial role in the success of the training program. It gives answer to what, why, in what way, when, achievements have been reached. Its main goal is to determine if the goals have been reached and if not what has to be done for the program to be efficient and successful. To answer that, the criteria in which they will be based to evaluate it, have to be clearly determined as well as the methods that will provide them analysis of the trainees' behaviors.

The Gamified Learning Theory

According to Landers (2015), the theory tries to explain the effects of gamification. The theory basically consists of two parts; the first one being the Game Element Attribute Categories and the second the Process Model. The model has two different paths which lead to learning. Either the game elements affect the outcomes through behaviors and attitudes, or the game elements affect learning through the effects of behaviors and attitudes and the instructional content.

The Game Element Attribute Categories are organized categories that try to link the learning outcomes of the application to non-game instructional methods. The categorization is based on psychological attribute. These categories are: Action Language, Assessment, Conflict/Challenge, Control, Environment, Game Fiction, Human Interaction, Rules/Goals. Once applied they can enhance the learning as they trigger cognitive retrieval of previously learned content (Landers, Armstrong & Collmus, 2017). Their combination can also improve the volume of change in learning behaviors and attitudes in comparison to implementation of each one individually. The only purpose of isolating them is for research purposes to understand and determine which element leads to which behavior.

The second part of the theory focuses on the process model and the casual relationships among instruction content, learning outcomes, behaviors and attitudes and game characteristics. For instance, the effect of instructional content on behaviors and attitudes. By improving the content, behaviors and attitudes change. Gamification though is of no position to replace the instructional content and as a result will not enhance the learning outcomes. Another example lays upon behaviors, attitudes and learning outcomes, as the attitudes have an effect on the outcomes. Lastly, there is causal relationship between game characteristics and behaviors, attitudes (Wilson et al., 2009; Tay, 2010; Bedwell et al., 2012; Hamari, Koivisto & Sarsa, 2014).

Which sets the enhancement of learner behaviors and attitudes as the main goal. The above-mentioned relationships explain how game elements can affect in a nondirected way the outcomes.

Outcomes

Gamification is uncountable for learning or transfer. These are the outmost, and also challenging to get, results. By definition, learning outcomes are results of experience and practice and can change perceptual and skill capacities. On the other hand, transfer is about applying these skills, the knowledge and the attitudes learned to the user's job. However, none of these can be directly targeted; they can be targeted indirectly through game elements, processes, and modules.

In order to enhance both learning and transfer, training motivation plays a crucial role. The training motivation gives explanations about the user learning behavior, the intensity, the quality. By increasing the motivation levels, the learning outcomes are improved, due to the fact that motivation acts as a beautifying factor.

Motivation relates to the game elements chosen, for instance game fiction motivated more the students (Malone, 1981), points, leaderboards, progress, bats, quests, avatars, elements increase motivation (Sailer et al., 2013). Accoding to Sailer, badges fulfil the user needs for success as they represent a status symbol, avatars give them choices, autonomy.

Even if the knowledge is transferred or not and if it can be applied to other contexts rather than training is an indication of the applicability of that knowledge and of what is thought. Research on the transferability has to be made yet. It is though essential to understand how the new teaching and training methods affect the learning process. In the context of learning, transfer has two different approaches: intramondial is the re-use of knowledge obtained in a virtual reality and intermondial which is essential the transfer between the virtual and the real world.

In order to access the gamification effects, it is important to examine the training reactions. These post-training opinions regarding a specific program are essential to feedback, marketing, remodeling-redeveloping the material used.

Gamification Moderators

It should be also highlighted the outcomes of the gamification interventions are affected from moderators. Moderators in gamification explain how the outcomes vary from person to person.

Person-level moderators try to interpret how each individual, who differs in characteristics, affects the effectiveness of gamification. Difference in experience, gender or even age. High experienced users tend to have better learning outcomes, rather than the ones with no or low game experience. Males tend to prefer achievement game elements, on the other hand female users lean to social game elements (Greenberg, Sherry, Lachlan, & Holmstrom, 2010). Users older in age have more difficulties in the gamified instruction then the non-gamified (Kovisto & Hamari, 2014).

Situation and contextual moderators are the explanation to the level gamification interventions assist on different situations and contexts. It includes the climate, the culture, the supervisor support and the user buy-in. How successful a training intervention is, depends on the supervisor support. Their positive view motivates the trainee-user and he might even have more optimistic reactions.

Gamification & Psychological Theory

Gamification and psychology are highly related; thus gamification is spreading. It triggers real, deep emotions through the modification of game elements and design approaches discovered from game science. In order to explain gamification as a design tool, it is essential to understand the psychological processes behind it, the spectrum of social and psychological processes. So behavioral psychology is required in order to understand it completely.

Behavioral analysis is a science category of psychology, and it is the base in developing principles and procedures used to engage trainees while they undergo a training program (Cooper, Heron & Heward, 2006). Its focus is on the accuracy in the understanding and control of the human behavior. It is proven and valid because of the empirical research behind it. Hens, gamification will be investigated through it.

Operant Conditioning

Operant conditioning, referred to instrumental conditioning, is a method of learning where the consequences of a response determine the probability of it being repeated. It is the process in which the frequency of occurrence of the behavior is modified by the consequences of the behavior (Reynolds, 1968).

In other words, a rewarded behavior is likely to be repeated and on the other hand a punished one is likely to occur in lower frequency. There are two different types of operants; the reinforcers and the punishers (Skinner, 1953). The reinforcers, can either be positive or negative, and tend to increase the probability of a specific behavior to be repeated. On the contrary, punishers decrease the probability of a repeated behavior.

Regarding gamification it can be defined as he next evolutionary steps which combines the Operant Conditioning techniques of rewards and consequences. Game elements such as points or badges, are used to drive the user to complete a task or target a specific behavior. They take advantage of them being perceived as rewards. That makes the user more likely to engage positive.

A fundamental aspect of gamification is the right motivation, the kind of motivation which builds the expectation for a reward. These incentives can be any kind of reward the trainee thinks it is worth it. People consider different things as rewarding, depending on their need, values and goals.

Expectancy-based Theories

Expectancy theory, introduced by Victor Vroom at the Yale School of Management, suggests that the behavior motivation is triggered by anticipated results or consequences. Their motivation is based upon their beliefs regarding their behaviors. In conclusion, the way an individual behaves depends on the result they expect from this particular behavior. For instance, a student will study harder if their effort will be rewarded with a higher grade.

This theory has three different components: expectancy, instrumentality and valence. To begin with, expectancy refers to the individual's belief that their effort will lead to intended goals. It is based upon past experiences, self-confidence and how difficult they believe it is to reach the desirable goal. It is highly associated with their abilities to complete a task successfully, control and goal difficulty. Instrumentality is the belief that the individual has that to achieve a desired outcome, their performance expectation has to be met. In other words, it's the perceived probability that a specific behavior will result in a reward. This reward could be a promotion, recognition, fame, money. Lastly, valence is the value an outcome has for the individual. It is associated with needs, goals, preferences, strength and motivation. An outcome one finds motivating, may not be for another.

If these three components could be described by simple sentences, then Expectancy would be described as "I can do this", Instrumentality as "If I can do it, I will get that" and Valence "I want it and I find it desirable".

Gamification can take advantage of the expectancy theories and use game elements to promote certain actions and behaviors. Badges, leaderboards can motivate individuals that value status, reputation, accomplishment, and achievement. Points can connect effort, performance, and

results. Check points that reward the user by the level completion is a classic example of instrumentality and the connection that exists between task completion and reward. That results in increased motivation and promotes competition. Game elements connect desired outcomes with motivation.

Self-Regulatory Theories (SRT)

Self-Regulatory Theory (SRT) is a system of conscious personal management which involves the process of guiding one's thoughts, behavior, and feelings in order to achieve certain goals and results. It can be described as the role that the individuals play in order to direct their development course be pursuing and setting goals, modifying them. It acts as mediator between set goals and performance (Kanfer & Acherman, 1989).

There are four different moderators of this goal-performance: commitment, feedback task-complexity and last, but not least situational constraints (Locke & Latham, 2006). Individuals are committed to achieve a particular goal, only if it has importance for them. Through feedback they can see their progress. The complexity of a task, how effective a goal is, depends on how effective their strategy to achieve it is. Performance can be driven by setting goals, but time and resources must be available.

Regarding gamification and SRT, leaderboards, badges and other game elements align with the goal-setting theory (Antin & Churchill, 2011;Hsu, Chang & Lee, 2013). Motivation can be triggered as users focus on achieving the goals they have set even if they are moderate, easy or difficult. Users have to perform at that level in order to achieve them (Landers, Bauer, & Callan, 2017). In order to take advantage of the theory, all four moderators shall be implied.

Self-Determination Theory (SDT)

Self-Determination Theory (SDT) suggests that people can be motivated to change and evolve by fulfilling three innate and universal needs: competence, connection/relatedness, and autonomy. Competence is the sense an individual has that they can do a specific task, because have mastered it, Connection/Relatedness is the sense an individual has that by doing an activity, they are cared for, and they make a difference and lastly Autonomy is the sense that they have control over their selves and features that support it are customization, individual goals.

Game elements can support the satisfaction of needs (Ryan et. al 2006), the extent each of the elements can contribute and in what way is still undiscovered. More research has to be done in order to match game elements and motivational needs. Also unknown is how many elements shall be used and their most beneficial combination. Long-term effects of gamification need further analysis.

Their behavior regarding them is based on intrinsic and extrinsic motivations. Intrinsic is the will someone has to do an activity for the purpose of enjoyment and satisfaction. Extrinsic motivation on the other hand involves completing a task or behaving in a certain way because of outside causes, for instance to receive a reward or avoid a penalty or punishment. In this case, satisfaction and enjoyment are not a priority. An example that highlights this difference is playing a game because they find it enjoyable and makes them happy (intrinsic) and playing a game to increase the chances at winning a challenge (extrinsic).

Ryan and Deci examined the Self-Determination Theory as a theoretical foundation in gamification. Game elements have shown signs of assisting in enjoyment and increasing the

user's intrinsic motivation since they fulfill the basic needs of competence, relatedness, and autonomy. These needs can be satisfied by obtaining points and/or rewards based on their performance, receiving positive feedback based on their actions, increasing the level of difficulty based on their level (Ryan, Rigby, & Przybylski, 2006).

Based on research, (Mekler, Brühlmann, Tuch, and Opwis, 2017), game elements, such as levels, points, leaderboards, increased the user's efforts while completing a task. Studies of Jung (2010) and Mekler (2013) also confirmed the higher appearance of desired behaviors with the application of game elements in non-game contexts. All in all, when game elements are successfully included in games, they do have a positive effect on the user's behavior.

Gamification & Practical Recommendations

After examining the Psychological Theories, it is of essence to examine the game design literature and recent outcomes of gamification as it is extremely complicated to dissociate psychology, psychology of games and gamification itself. They are interconnected.

Practical recommendations and tools to increase motivation, learning level and completion rate of the training program will be further analyzed. Thus far, only few sources exist which provide methodological insights and practical recommendations on ways to design game-based training methods. Also, the majority of these frameworks have not been empirically evaluated. Published literature is not sufficient to provide useful insights on the practical guidance.

Training Design Process

The fundamental behind a successful gamification process is to have a real problem that needs to be solved through specific training. An assessment and a training evaluation study have already been conducted by the designer. Once it has been identified and it fulfills the above conditions, gamification can be implied and aim to enhance motivational and affective deficits. At this point, is must be stated, that because gamification is a fairly new method of training, its literature and results are not enough to improve a training when its gaps are not clarified. In that case, simple and known methods can be implied in order to develop its context.

Gamification is a slow and incremental process towards its affection in the training process. Training content and methods are modified with the use of game elements, such as badges and progress bars upon level completion. In that way, the training can be compared with a game in which even more game elements are implied. These elements include images, sounds, feedback. This although does not necessarily reach the final goal of the training and it should be only used in order to enhance specific aspects of the training.

The process in which gamification should be implied is firstly completing an evaluation and discovering what truly needs to be enhanced in order to optimize the training process. In that way, the game designers will find out what trainees like in training and what needs to be changed. For instance, users might not respond well in the training and a new type of it shall be implied. All in all, when trainees' behavior does not change as it should be, then a new method shall be applied. The outcome shall meet the end goal and it can only happen if the actual problem is identified.

Psychological Mediators & Game Elements

A psychological mediator is a variable that changes the nature of the relationship between independent and dependent variables and how or why a relation between them exists. To target them with game elements, the designer shall do a need analysis for gamification (Surface, 2012) and discover the psychological characteristic(s) that need to be improved. This can be done via surveys for instance to collect the basic data for an evaluation. By doing so, it is likely that the reasons behind a non-effective training will be revealed. The data includes learning retention and application, reactions, and the user's behavior.

Once selected, the designer shall be able to identify the cause and the problem by measuring each criterion with an ideal level or percentage. The problematic criterion will reveal the gaps in the training process. Then, these "gaps" can be prioritized, and gamification shall be implied in order to eliminate them. The gaps are usually prioritized based on the cost that they reflect on a company or organization. Given a specific gap, it is essential to evaluate what causes it and that may require further surveys and data analysis, which will eventually lead to the cause in fact that needs to be targeted and improved. Then the game elements come into life. Through the list of the possible gam element categories, they should be considered to be added into the training process. Game elements such as rules, goals, feedback, score can improve the training method and provide an optimized game experience during the training. Also, media, images, videos, activities can have the same effect.

Following the implementation of the game elements new data shall be collected in order to compare and evaluate the enhanced and redesigned training process. If the problem still exists, then the whole process shall be repeated including a needs assessment and/or a gap analysis. As a result, different game elements shall be implied so as to solve the original problem. There

is a possibility that the gap is partially covered in which a non-targeted learning outcome has decreased. Then the designer may have to do another assessment and resolve the problem.

Conclusions

Gamification is not a new approach as it persists of existing training design techniques. What is new though is how scientifically based are the targets by using game elements and how both psychological and games research provide useful data regarding an enhanced training process.

Human Resource Management & Gamification

The integration of gamification in the workplace has become a common practice. It is an encouraging method in the Human Resource Management (HRM). Behind the design of different frameworks, taxonomies and game elements lies an abundance of research including systems, designs, architectures, use of game elements. The objective of gamification in the business industry is the application of techniques from the game design and tis implementation in non-game contexts, with the goal to achieve high engagement levels.

Concerning HRM, gamification targets the trainee's motivation, engagement, and performance. Based on research, gamification leads trainees in developing work-related skills (Dubey et al., 2016; Ergle, 2015; Jabagi et al., 2019; Rugi, 2015). It is found that they think of their working tasks as more interesting and challenging (Liue et al., 2018.; Sarangi and Shah, 2015). There lies the reason that organizations globally use them to solve potential issues and also tap into new talent pools

The power gamification has, comes from the competitive human nature the individuals show, while playing games. Then through gamification this dedication and absorption is exploited. It is common that the trainees try to achieve their goal in any possible way and as they progress in the game, their engagement rises. Behind their performance, lies the competition.

In these days, employees need to think outside the box and bring innovative ideas to the projects. Game elements can be used as tools for them to better understand the software process; the logic behind decisions. By doing so, the engagement and work motivation are boosted. A characteristic example is the use of gamification in the salesforce compartment. The employees, salespeople, see the game elements such as rewards, badges, point systems as motivation to

attempt to increase their sales. These game elements trigger their work motivation and their desire to strive for achievements.

Training in the workplace

The current psychological research concerning serious games' focal point is the immersive environments which are created based on the real world. As an example, the majority of military videogames is a 3D environment where users perform tasks and basic drill exercises in order to succeed in missions (Orvis et al. 2009). This kind of game, the simulation one, tends to maximize the fidelity of its environment, combining elements of simulations and games (Wilson et al. 2008).

Simulations can help fill the gap that exist between knowledge and action. Its content must be characterized as Behavioral, "What action must the trainee do?", Observable, "What would we see the trainee doing?", with defined consequences and outcomes and also process-driven and/or system-driven, by changing a singly aspect of the system, it potentially affects other parts of the system.

Gamification boosts the trainee's confidence by succeeding in their tasks and projects and also increases their motivation in their training process (Jorge and Sutton, 2017; Stadnicka and Deif, 2019). Several models and frameworks that describe the use of gamification have been introduced by studies over the years. Between their findings worth mentioning is the high importance of turning the workplace into a place with more fun for the employees (Jorge and Sutton, 2017). It is an auspicious chance that behavior will swift regarding their strategies and their goals, as well as their engagement.

Another finding suggests that through the training process, the employees tend to show an increase in their loyalty and effectiveness and as a result the customer satisfaction is enhanced (Miller, 2018). Park and Kim (2019) suggest that badges measure knowledge and skills and

also deliver higher engagement. Petruzzi and Amicucci (2015) verify that the instant feedback reflects on the individual towards their behavior. Kornevs (et. al 2019) also suggests that gamification acts as a motivation for employees to acquire and apply new knowledge.

Talent management measures

Several studies have shifted their focus into the application of game elements in the talent process. Gamification can be used effectively in the talent identification and in assessment centers (Georgiou et al. 2019; Tansley et al. 2016). Gamification is a key tool in the soft skills' identification and as a result it immediately eliminates the non-effective hires. Prior studies have examined the correlation between cognitive skills and mental processes needed to score a victory in video games (Foroughi et al. 2016; Quiroga et al. 2015; Unsworth et al. 2015). The individuals that enjoyed playing online games and role-playing tend to show more coordination and leadership skills.

Outcomes

Through the examination of studies, there is empirical evidence that suggests the positive interconnection of gamification and employee engagement, motivation and satisfaction (Kumar and Raghavendran, 2015; Liu et al. 2018; Shahri et al. 2019). Game design elements do also have a crucial impact on talent acquisition and last, but not least, gamification can transform the entire organizational culture.

Designing and Risks in HRM

The application of gamification in the Human Resource Management training suggests that specific game elements are applied. Among them badges, points, leaderboards (Araujo and Pestana, 2017; Dessureault, 2019; Ergle, 2015; Liu et al. 2018). Most recent evidence though shows that the gamification has to be human-centered. As stated (Hunicke, 2004), it is of outmost importance to understand the way that decisions affect the end user experience. In that case, it is easier to decompose the experience and take advantage of it in other designs and research. By doing so, more feedback from various users is going to be gathered and overall there will be an ongoing improvement in the gamification design which will eventually result in growing effectiveness.

One cannot see the positive side of gamification and ignore its risks. Evidence gathered, shows how positive feedback can enhance the performance of an individual. What has not been said though, is how the negative feedback affects them. Sailer and Hommer (2020) discovered that negative feedback can be perceived as control and lead to the reduction of motivation. Likewise, leaderboards can lead to pressure and comparison (Forsyth, 2018; Shahri, 2019) and also to intimidation (Algashami, 2017). The risks abovementioned are by now known by the scientists who consider them when implementing gamification (Araujo and Pestana, 2017; Jorge and Sutton, 2016; Park and Kim, 2019; Ruhi, 2015). The long-term effects of gamification have yet to be explored.

The research about gamification is still in fundamental levels. Thus, many more studies and literature updates are to be explored. In a first sight, gamification can improve human resource practices. To continue the research and receive useful feedback, there has to be a consensus definition of game design elements; a common meaning.

Training & Theoretical Framework

The aviation industry demands the staff to be skilled and not lack professional competency. There is a need of knowledge and expertise in the aviation industry. Employees must have the skills to perform particular tasks.

Skills can be divided in categorized based on type or level. They can be classified into three (3) different types: transferable or functional, attitudes and knowledge based (SkillScan, 2012). Transferable or functional skills suggest the actions taken in order to complete a task, attitudes are developed based upon experiences, knowledge based as expertise that can be developed through training and education.

Another classification is based on soft and hard skills. Soft ones can be thought and hard can be quantified. Based on the SkillScan (2012) classification, hard skills match to knowledge-based skills due to the way they can be learned via text, manual or training. Soft skills are more personal and can be compared to attitudes and transferable.

Studies in the aviation sector (Loffi, Bliss & Depperschmidt, 2013) suggest that there are critical skills the aviation security professionals need. As an industry, aviation is highly regulated, and security is a priority in the operations and risk management. The way which the airport environment functions and the understanding of its laws and regulations is essential. Among the standards in the Australian Aviation Industry as published in 2016, its workforce is required to have technical skills, problem solving, analytical, risk and safety management, as well as digital literacy. All the above have to be also adapted in new ways of working in the future and most importantly they can be trained through gamification.

Cisco Systems Inc, Intel & Microsoft did an ATCS analysis in 2008 that suggest the 21st century skills: Creativity and Innovation, Critical Thinking, Problem Solving and Decision Making, Learning to Learn, Metacognition, Communication, Collaboration, Information Literacy, Information & Communication Technologies Literacy (ICT), Citizenship, Life & Career, Personal & Social Responsibility.

If the ATCS analysis and the research in the aviation sectors are compared, similarities would be pointed. Its definition lies to the fact that the fundamental skills remain the same.

Industry 4.0

The Industrial Revolution emerged the transition to new manufacturing processes. The change from an agrarian and handicraft economy to one single dominated by machines and manufacturing. The technological advances introduced new processes of working. Artisans were replaced by skilled workers, mass production of goods and factories took place.

Regarding the industrial processes, novel methodologies and tools were proposed in order to achieve better results. Better results consist of less cost, more productivity and team building, and also better methods in managing the processes. In the present day, most of the activities are either controlled by machines or are automatic.

The term of Industry 4.0 is the fourth revolution and is the present trend of automation and data exchange in manufacturing technologies. It presents the need to convert the regular machines to self-learning machines and improve their total performance and interaction. It involves digital innovation, globalization. Products and services are being developed, providing the customer more values. It is known as servitization (Bustinza et. al 2015l Shi et al. 2017; Andrews et al. 2017).

The way of interaction with the potential customers calls for flexibility and agility in the entity of industries, which triggers the necessity for enhanced employee qualifications and also training solutions that will contribute to the production (Muller et al. 2016). That emphasizes the need for employee training.

As Industry 4.0 develops, technology advances and more and more electronic devices and new software are being used. Therefore, games have been influenced and they have a great impact

on both society and industries. So, the implementation of gamification is recommended. The new generation has grown up using games on various electronic devices and they are more accustomed to gaming experiences (Schuldt & Friedermann, 2017). The questions that arise are related to which aspects of gamification can support the 4.0 Industry and its benefits in the training process.

Applying gamification has its own challenges. For instance, it shall only be applied if it is adequate with the learning processes and goals of the company (Schuldt & Friedermann, 2017). Another aspect to take into consideration is the importance of involving the employees in the process of the game implementation techniques at the design process (Korn et al. 2017). It is also essential that the employees are not obliged to use gamification methods, but they choose to (Liu et al. 2018).

Aviation & Challenges

During the last two decades, the total number of passengers has almost doubled. More new technologies are also applied into everyday operations. The focus is on the customer satisfaction. That requires employees to adjust their skills in the environment, jobs to be transformed and new tasks to be created.

That was before the Covid-19 pandemic hit the industry. Its impact was devastating; the flights were reduced to a minimum, fleets ware grounded. That has been a huge crisis for the aviation sector. Couple of researchers, despite the crisis, argue that this is an ideal timing to rethink and redesign (Macilree and Duval, 2020; Wilson and Chen, 2020, Suau-Sanchez et al. 2020; Gossling et al. 2021; Tisdall et al. 2021). One of the potential avenues suggests the rethinking of daily operations and processes which means taking steps towards digitization and automation.

The potential avenues point the key directions to reach the goal of pandemic-resilient aviation. Pandemic-resilient has the meaning of a sustainable pandemic outbreak, Covid-19 in this case, by the reallocation of the resources and decision making while minimizing the impact of the external events. Of the challenges regarding it, the technological innovation and education of the professionals will be further discussed as they have the most effects on the ultimate goal.

The term of technological innovation as well as the education in the sector of aviation have a broad meaning. This paper focuses on the automation regarding operations and how gamification can be applied in the enhancement of the employee's abilities. The problems Covid-19 has revealed effect the aviation system in a degree that the use of technologies

emerges. Challenges, such as smarter airports and airlines, educational practices for the professionals to handle the new technologies have to be controlled.

“Smarter” Airports

Throughout the recent decades, passengers tend to be sensitive regarding waiting times when in airports, the quality of service in the airport processing time, the amount of time spent between arrival and departure (Bezerra and Gomes, 2020). Many airports and airlines followed the Fast Travel Program, an IATA initiative. Its focus was on self-service options with the goal to address the traveler demands, reduce the airlines’ costs, enhance the overall efficiency of the airport infrastructure as well as the customer service. The program though was terminated in 2019 as it was too demanding and self-progressing. The customers were able to self-check and obtain their boarding passes, print and attach their own baggage tags, self-scan their travel documentations, re-book their flight, self-board and also recover their luggage if lost.

The goal still of airports to be characterized as “smarter” is to be document-free and be able to offer touch-less experience to the customers, enabling them to do self-identification at check points. One of the main areas focused is the RFID technology which can be used in the luggage tracking and security checks (Shehieb et al. 2016; Baashirah and Elleithy, 2019; McCoy et al. 2005). A cellular network of passive RFID receivers is combined with far-field active RFID tags. This technology though still calls for physical process of the tags which considering the pandemic is not ideal.

Another technology is the touchless fingerprinting that its research that has been studied for more than a decade. The challenges traditional fingerprint faces can be surpassed through the touchless, such as latent fingerprints or distortions caused by the pressure of the fingers on a sensor surface. Regarding reliable detection new challenges must be overcome too. Issues such as the interface or the focus on the finger and its image process.

Last technology would be the gesture and face recognition that have shown an extreme advance over the years through deep learning. According to Future Market Insights, Covid-19 is expected to drive the market for contactless biometrics to 70$ billion by 2023. Abu Dhabi Airports have already deployed touchless gesture recognition to the elevators in order to prevent the spread of the virus though commonly used surfaces. The technology known as "Tchk", Touchless Keypad Technology, gives passengers the ability to choose the floor or direction they desire to go just by waving their hand. Tchk is provided by UAE startup Meta Touch based at the UAE University of Science and Innovation Park.

The investment beforementioned is just the beginning and an example of the digital transformation airports undergo. Covid-19 though seems to pinpoint the gap that has yet to be fulfilled in order to reach the pandemic-resilient goal.

Educational Challenges

Employee Engagement is one of the most significant measurements to the HRM efficiency for staff turnover. New tools and methods have to be investigated as the next generation joins the workforce. The majority of the employees have adequate or even negative perception of their work (Linley, Harrington & Garcea, 2010). Their motivation comes from the need to survive.

Through their engagement, the productivity can be boosted, the work can become meaningful and the goals inspiring. Evidence suggests the engagement games bring to their behavior. In order to achieve that, the new technologies have to be used correctly by the professionals, in this case at the airports. Therefore, a fundamental shift in their educational training process has to be applied. The required skill set has to be matched between their education and the tasks they have to perform.

The entire aviation industry has to meet the digitalization needs. Covid-19 has impacted the aviation workforce and caused the restructure of the airlines. New emerging, technology-based occupations in aviation are introduced. Design and Operation of automated vehicles which will be the future of the industry. Semi-automatic vehicles will be designed to handle the luggage, maintain the aircraft. Although they will be highly automatized, there is still a need for their programming and their supervision.

AI and Data Engineers will be in need for the development, operation and maintenance of systems that will integrate the artificial intelligence and data science techniques into the aviation industry. Such engineers will have to be expert in computer science and also in aviation. To continue, Privacy Protection Analysts will have a place in the industry as the data and integration systems advance. Their tasks will cover a wide area of privacy protections, among

them technical and legal perspective. Lastly, the distribution of integrated and adaptive systems will cause the connection of data and interfaces to the public. Cyber Security Experts will have to handle this task.

The new occupations abovementioned are just a sample of the jobs on the aviation horizon. There will be more that will demand a high-tech skill set and training (Lappas and Kourousis, 2016). In order to meet the qualification required, gamification is proposed to help them advance and grow. It is of urgent need to offer the employees an appropriate training and make them capable to handle the new technologies.

Each trainee responses in a different way to the same game elements. Tondello (et al. 2018) suggests the extensive interest researchers have shown in understanding how the different psychological characteristics of every individual can impact their experience, their understanding and response to the game elements.

Training

Aviation, as of today, bases its training in safety since 1979 (Kearns, 2016). The outcome of it is the effective use of every available resource which leads to a safe and efficient flight operation (Jensen, 1997; Helmreich and Merritt, 2000). Since the early 2000, distance learning methods were introduced for aviation to take a shift and base its training in them (Raisinghani et al. 2005; Scarpellini and Bowen, 2018).

As Kearns (2016) states, distant learning training has not met its full potential, due to the fact that the courses lack quality, and the learning environments were not taken into consideration. Another reason is the lack of commitment and effort by the teachers to prepare them. The online material requires dreadful time, effort and budget and the resources were often absent. Apart from the technical issues, insufficient motivation of the trainees is also a challenge.

Recent research on education suggests that trainees require an even higher level of engagement in learning, which is contradictory to the remote learning methods. On the other hand, the use of games as a training method could revolutionize their education (Kapp, 2012; Miller, 2013, Gentry et al. 2019; Deterding et al. 2011). Some issues that are concerning though are the high cost and time they require (Kapp,2012), the specialization of each game as it targets specific skills (Dicheva et al. 2015), the expertise of the game designers as it is mandatory for them not to be just computer scientists and graphic designers, but also aviation experts with human-computer background as well as psychology. Lastly, so as to achieve the design of a game effectively, a group of people and experts are needed.

To maximize the impact of the training program, the objectives must be targeted and meet the learning needs. Each of the objective includes capabilities, such as knowledge, observability,

problem-solving, attitudes, that the instructor desires to target. In order to train each of these capabilities, specific course objectives have to be drafted. When the above list of objectives has been addressed, specific instructional methods must be chosen. The difficult task that comes up is how to choose the appropriate game given the objectives.

Gamification in the aviation industry commands an investment of human and financial resources that the stakeholders are not yet willing to provide as gamification is a rather new tool which results are not enough tested. With the ongoing advances of technology and automation, though it is of outmost importance to create an interaction between machined and people. The next generation must receive proper training and gamification is a promising tool.

Gamification has great potential if exploited. It can literally transform systems, services, organizations, activities. Researchers try to approve the positive outcomes of gamified systems. Recently, more progress has been made to analyze the mechanisms behind gamification and its outcomes, but most importantly how it affects the behavioral outcomes.

Gamification and VR

Through gamification and serious games Immersive Virtual Reality (VR) is also proposed. VR has already been used in sectors such as military and medicine for training purposes and is more and more being used in industrial and manufacturing spaces (J. C. Silverstein, F. Dech, M. Edison, P. Jurek, W. S. Helton, and N. J. Espat, 2002; R. Hill, J. Morie, J. Rickel, M. Thiébaux, L. Tuch, R. Whitney, J. Douglas, W. Swartout, J. Gratch, W. L. Johnson, C. Kyriakakis, C. LaBore, R. Lindheim, S. Marsella, D. Miraglia, and B. Moore, 2001). As training includes game design techniques, the creation of educational applications of VR could be more engaging and attractive.

Virtual Reality gives the trainee the ability to immerse themselves in a world they have complete control and there are no effects from real life to interfere. Trainees can be educated with the fundamentals, but also be prepared to deal with complicated and difficult situations without getting harmed while on training. According to the Fatal Flight Training Accident Report for the period of 2000-2015, more than 50% of fatal training accidents were caused by the loss of control in a flight and 10% by mid-air collision. As expected, a more effective method should be used.

Thus, safety education could be a very promising field of serious games. Under danger, for instance an aircraft accident, both trained stuff and passengers are overwhelmed with emotions and do not pay attention to the safety measures. The industry is divided by the effects of Virtual Words. It is agreed that pilot training is demanding, and its replication is debatable. With the flight stimulators, the pilots under training can for example reach for oxygen masks and feel the plane’s vibrations, which make the training realistic. There are parts though Virtual Based

programs cover. For instance, the training of the ones who suffer from Post-Traumatic Stress Disorder (PTSD).

Safety Education

In the aviation industry, human errors could lead to disastrous consequences. A failure could cost thousands of human lives. Between 1959 and 2015, up to 60% of aviation disasters that could be prevented blame the pilot error. This emphasized the importance of their appropriate training. With the intent to eliminate these errors, the aviation organizations have been providing training in crew resource management, known as CRM, for more than a dozen years.

Gamification can be a useful tool in the Safety Education to prepare people to prevent and handle such situations. Safety Education is mostly based on traditional media which lack or have limited effectiveness in the training process. Reports from the US Federal Aviation Administration (FAA) suggest the use of new tools for educational purposes (FAA, Washington DC, 2008).

Through gamification, trainees can be provided with interactive, realistic virtual experience and become more engaged. This kind of "games" prepare the trainee to prevent and/or handle risky situations, such as an aircraft emergency evacuation. Aviation safety education requires lengthy instructions, and it simultaneously concerns a great number of passengers. Passengers have to be accurately informed about cabin safety and other protocols while traveling.

At that point, the military aviation has to be emphasized as one of the most dangerous and complex occupations worldwide. It includes complex factors for a sustained flight. Even small unimportant errors can lead to hazardous consequences. In this category falls the maintenance personnel. Its complexity is the main reason armies and military forces use simulators which through the years have advanced into computer programs that give users the opportunity to relive real battle events.

Case Study Scenario, Emergency Evacuation

A topic extremely important in the aviation sector is the emergency evacuation of an aircraft and also a severe weather condition. While in air, the key to a successful control of the aircraft is the immediate analysis of the situation, which follows the consideration of the alternative options and likewise the compromise of them to finalize an action based on the best one. The entire process has to be executed to the point and on time.

In case of an evacuation, it has to be fast and safe during the emergency, because of the extremely tight time window of two minutes since the fire erupts (Miur, 2004). Incident and accident reports state the inappropriate behaviors performed during these evacuations that risk their survival (National Transportation Safety Board, 2000).

It is highly impossible to train an employee for such incidents. Wind Shear, Thunderstorms, Microburts are difficult situations which can only be trained while flying the aircraft. Many aviation engineers also lack the hands-on expertise with systems such as turboprops and jet engines. As a conclusion, the actual flight training is limited, and flight simulators are used. This way, they can simulate a variety of dangerous situations which in real-life could be fatal. Full Flight Simulators (FFS) can offer advanced motion, graphics, communication and also air traffic control, but their cost is extremely high, and it becomes more and more expensive year by year as the types of airplanes released increase.

Through gamification and virtual reality, trainees could have more time to train and experiment with less cost. Especially during the Covid-19 pandemic which caused a limited access to flight simulators and there was a need for another tool to be used. Virtual Reality could minimize this gap. Virtual words are becoming more and more tempting as a revolutionary training method.

The user can become immersed through the 3D, multimodal virtual reality settings which tend to be less expensive than flight stimulators.

A replication of the environment and interface is created. The users should become more aware of critical occasions. Trainees would be able to examine a recorded flight and learn from it. They would be able to locate the closest exit and use it, find alternative exits, leave luggage and personal things on the aircraft, stay away from fire and smoke, but also be fully aware of competitive, survival behaviors such as pushing.

Focus on the decision-making process, as it a pivotal aspect of emergency response exercise, must be given. The process of decision making in the context of a crisis, or a disaster are fuzzy (Van de Walle, Van den Eede & Murhen, 2009). Thus, the difficulty to reflect with accuracy how the decisions are made. The outcome of such decisions could be quantified to a certain degree, the process leading to them is based on a variety of sources and processes (Van den Homberg, Messters, Van de Walle, 2014).

There is a link between disaster-based exercises and games (Susi, Johannesson, Backlund, 2007; Di Loreto, Mora & Divitini, 2012). The two important elements were planning and delivery (Gagne & Driscoll, 1975). Planning includes the preparation of activities and is often referred as narrative in serious games. Delivery is the presentation and or the execution of the activities abovementioned. The end game is designed based on them and intends to include the most sufficient ways to deliver the learning experience, delivery, and aim to enact changes in behavior.

In disaster-based games it is important to plan the learning objectives, the constructs that determine the decision-making process. Feedback and evaluation of the trainees and their performances have to be considered.

Airbaltic Case

AirBaltic Corporation it the Latvian national airline which underwent a crisis in 2011. Consequently, the employee commitment was low based on surveys the company ran at the time. In a period of years, the management tested different measures so as to increase the commitment score. Their efforts were fruitless.

Then they introduced the Forecaster tool. Forecaster is a gamified electronic platform introduced by the AirBaltic Corporation in 2014. Its purpose was to intensify the employee engagement. It was launched as website with a prediction game format. With the objective to earn prizes and win financial rewards, the trainee should have the most accurate predictions and comments. These predications would indicate their opinions and ideas in upcoming decisions and business-related projects. Their feedback could enhance the quality management decisions and also save a large amount of financial resources. Their comments and predictions were collected, analyzed, and taken into consideration by the management group.

Overall, the flow between employees at different levels was restored. It suggested a significant impact and enhanced engagement in their behavior. As the trial 5-month period ended, the staff that took part, 60 members in total, suggested that they enjoyed the process and were also more informed about current projects and decisions. In the midst of the results, trainees were able to foresee scenarios that the management has not thought of. Among the employees there were discussions and recommendations of their thoughts of the game, and they had also shown more interest in learning business-related news in a game format rather than a formal newsletter.

Finally, it proved to be a valuable tool to raise the engagement levels. Forecaster was a successful tool for the companyIn order though to have greater impact, changes still need to be done.

Conclusion

Today's culture is highly associated with games and technology. "The gamer generation is part of a society used to collecting airline mileage points and open table dining points in the same way they collected gold start in kindergarten" – Sheldon, 2012.

Computer game-based training methods have been influencing the industries for the last years (Squire K, 2005). The modern training systems offer the trainee great interfaces, life-like virtual characters and well-designed structures. Complex and demanding interaction scenarios meet well designed and accurate interfaces. Their focus is still on learning rather than entertaining purposes, though gamification aims to create a sense of playfulness in non-game environments.

In order to keep the trainee motivation high, the training requires adaptability and flexibility in order to understand the current situation and be modified accordingly. Thus, there are different types of teaching and training methods, not all of which are suitable for every situation.

Gamification, the concept of applying game-design thinking to non-game applications to make them more engaging and entertaining, can be applied with confidence in the aviation industry. Progress in its design, technology and application must be made. More research must also be done.

It has proven to be a powerful tool in the new era of industries, and it can contribute to an increased employee motivation. It can impact the productivity, the efficiency, and the job satisfaction. Concurrent it can effectively enhance their training and learning, as well as the decision-making process. Its full potential has not been met yet.

Works Cited

https://courses.lumenlearning.com/wm-introductiontobusiness/chapter/expectancy-theory/

https://www.psychologyinaction.org/psychology-in-action-1/2015/02/06/mediating-and-moderating-variables-explained

https://educationaltechnology.net/the-addie-model-instructional-design/

"The effects of a gamified human resource management system on job satisfaction and engagement"- Mario Silic, Giacomo Marzi, Andrea Caputo, P. Matthijs Bal (2019)

"Gamification in human resource management-Status quo and quo vadis" – Lena Muraski (2020)

"Technological and educational challenges towards pandemic-resilient aviation" – Xiaoqian Sun, Sebastian Wandelt, Arnming Zhang (2021)

"Gamification for Data Gathering in Emergency Response Exercises" – Kenny Meesters, Aaron Ruhe, Marvin Soetanto (2015)

"AirBaltic Case Based Analysis of Potential for Improving Employee Engagement Levels in Latvia through Gamification"- Daiga Ergle

"Skilled Staff in Finnish Aviation Industry"- Sanna Aittola & Tuulia Salokannel (2020)

"VR Based Aviation Training Application For Avoiding Severe Thunderstorms"- Thesis by Afsoon Bahadoran Baghbadorani (2021)

"Game-based Learning with Computers – Learning, Simulations, and Games" – Alke Martens, Holger Diener, Steffen Malo (2008)

"The gamification of learning and instruction: game-based methods and strategies for training and education"- KM Kapp (2012)

Prospects for using gamification in Industry 4.0. Production, 30, e20190094. - Reis, A. C. B., Silva Júnior, E., Gewehr, B. B., & Torres, M. H. (2020) https://doi.org/10.1590/0103-6513.20190094

https://www.iata.org/en/programs/passenger/fast-travel/

https://www.biometricupdate.com/202006/abu-dhabi-airport-deploys-gesture-recognition-to-elevators-to-prevent-covid-19-spread

https://en.wikipedia.org/wiki/Industrial_Revolution

https://www.britannica.com/event/Industrial-Revolution