A vignette study among order pickers about the acceptance of gamification

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Abstract. A high percentage of total logistics costs can be attributed to order picking. Since order picking is characterized as rather monotonous, pickers often struggle with motivation due to the monotony. This article provides insights into the acceptance of gamification in order picking by using gamified feedback features for motivation. We conducted a vignette study with order pickers to investigate the individual perceptions of motivation, job characteristics and gamification. The findings indicate that gamification in the order-picking sector appears to be a suitable approach to increase motivation and performance of pickers. The use of gamified feedback features was positively rated for both individual and group performance and showed no significant preference of one type. More research is needed to generalize the findings to a greater population.

Keywords: Order picking, gamification, logistics, motivation, performance, vignette study, feedback feature.

1 Introduction

Order picking plays a pivotal role in logistics and accounts for about 55.0 % of the total warehouse operating expenses [1]. Despite increasing automation and use of highly automated storage systems, manual operation still represents the vast majority of order picking systems. Automated systems for picking could be implemented but would require costly investments. Indeed, these automated systems still struggle with the need for human intelligence. Heterogeneous and changing product portfolios and dynamic market demand require the high flexibility of manual systems and human skills [2–4]. Order picking involves intensive and repetitive tasks that are mostly done under time constraints with the aim of minimizing errors. Demotivation due to monotony is often connected with order picking and a widely discussed problem of a picker's job description. The monotonous task often results in problems with motivation and performance of the employees. In fact, these problems are often neglected and can lead to a lack of concentration, dissatisfaction and mistakes [2, 5]. Currently, optimization approaches for process improvement are mostly limited to technical aspects, forgetting about the human factor. As a result, the motivation of pickers is crucial for an efficient logistics system [6].

As a nascent area of study gamification has been applied in the logistics sector to improve motivation and performance of workers, in particular of pickers [7]. Gamification refers to the use of game elements in non-game contexts [8] and represents a new approach which aims to increase motivation and performance. Previous studies found empirical evidence of an increase in motivation and performance due to the use of gamification [9–11].

We designed a questionnaire for order pickers about the acceptance of gamification and focused on gamified performance feedback. Our presented feedback features include several game elements which provide information about players' success [12], create a competitive environment, [13] and allow users to receive immediate feedback and to know exactly how they perform compared to others [14].

The aim of this paper is to investigate the acceptance of gamification of order pickers by using gamified performance feedback for motivational aspects. Moreover, it was investigated if gamified performance feedback on an individual or group basis are preferred by the pickers. Therefore, a vignette study with order pickers was conducted to investigate the individual perceptions of motivation, job characteristics and gamification. In addition, recommendations for the use of gamified applications for order pickers are provided.

2 Theoretical background

In this chapter, we discuss the importance of manual order picking in the logistics processes as well as gamification as an approach to increase motivation and performance in the logistics sector.

2.1 The value of order picking in logistics processes

Order picking refers to the procedure of withdrawing items from an inventory to complete an order. Certain quantities (articles) from a total quantity (inventory) have to be provided based on internal or external orders. Order picking has three major functions: acceptance and processing of picking orders, execution of the picking process and internal and external provision of goods [15].

Only a well-functioning picking system in collaboration with the warehouse creates additional value for internal logistics. Picking is considered a labour-intensive and costly part of the logistics network since picking processes are hard to standardize and automate. In fact, picking is responsible for approximately 55.0 % of the total warehouse operating expenses [1]. Despite the automation trend in logistics, pickers manually run around 80.0 % of all warehouses, because sensomotoric abilities enable humans to address changes in product characteristics, such as weight or size quickly [3]. Furthermore, humans are able to react faster and are more flexible to the markets dynamic demands. The human being will remain the key resource for a flexible and high-quality picking system in the near future [2, 5].

The overall objective of picking is an in-time and quantity correct provision of the ordered materials for internal or external customers at the lowest possible costs [16]. Pickers play a crucial role to satisfy these goals. The working process of picking is, in

general, described as rather monotonous. Simple and repetitive work sequences in a rather dull working environment are the main points of the job description of the pickers. Additionally, employees face high stress levels due to the time pressures exerted on them. The working procedures must be carried out quickly and accurately in order to meet the time target and avoid mistakes. Hence, motivational problems are ubiquitous but only rarely highlighted. The vast majority of the companies introduced monetary incentive schemes believing that these represent the only solution to tackle motivational problems. Optimisation approaches are often centred on technical aspects but neglect the employees and their behaviour. Nevertheless, motivation plays an important role in ensuring a fast and precise working method. In fact, the logistics industry is enhancing its efforts to identify more intrinsic rewarding systems such as gamification [6].

2.2 Gamification in logistics

A new approach to increase motivation in workspaces is gamification. Nick Pelling, a British computer programmer and inventor, first coined the term in 2002 [17] and it started to gain popularity from 2010. Gamification means the use of game-design elements in any non-game system context to achieve one or more of the following: intrinsic and extrinsic user motivation, facilitated information processing, better goal achievement, and behavioural changes [8]. Gamified applications can satisfy the three basic human needs of autonomy (through in-game decisions), competence (through ongoing feedback and progress), and social inclusion (through competition or cooperation with other players). These three human needs are intended to increase the motivation of humans [18, 19].

Previous research found that using gamified applications increases people motivation and engagement [20, 21]. By ascending leaderboards, collecting points and/or badges, a motivating effect occurs that encourages people to spend longer and more time on specific tasks or activities [21, 22]. Gamification is intended to lead people into the so-called "flow state" [23]. Flow refers to a state of joy and happiness as well as optimal experience, which results from intense participation and total concentration on the complete immersion in a pleasant action. The condition occurs when a person forgets all worries, self-doubt and any sense of time in the execution of a task. Such activities are experienced as enjoyable and rewarding in that they are exercised for self-purpose [24]. In addition, the balance between task difficulty and one's own abilities is crucial to reaching the flow state. If the task difficulty exceeds your own abilities, this can lead to overwork, loss of control and anxiety. If the task difficulty falls below one's own abilities, this can result in under-demand and boredom [25].

The integration of game elements can increase the motivation of people who work on monotonous and non-challenging tasks [9–11, 26, 27]. Previous studies found that gamification is able to improve performance in monotonous and non-challenging jobs [9–11]. An example of a gamified application in the logistics sector is the use of rewards. If gamified applications in the picking sector are used, pickers will receive rewards in form of points, etc. for a certain picking goal. Game elements such as points,

level-up or ranking promote voluntary participation and inspire employees to reach a higher level of performance and engagement [28].

An example for a gamified system for pickers is the application of Arvato. The IT provider Arvato Systems used gamification to increase motivation in the logistics sector. Different games, such as Tour-de-France, Formula 1 or football are coded and applied to a warehouse. Logistical workflows such as picking are adapted and implemented into football matches, tournaments or Formula 1 races. Various operating figures e.g. error rates are integrated into the course of the game. In the game, the employees are divided into teams. The progress of the game can be broadcasted via live-ticker on tablets or smartphones. Additionally, analysis and feedback options are offered to track team statistics. The game designers found that both performance and motivation were increased through the game [29, 30].

However, incorrect implementation of game elements can also cause detrimental effects. Leaderboards represent a game element that can enhance people's goal-setting and motivation due to (immediate) feedback about personal performance [31]. Even though leaderboards aim to motivate users, it can result in the opposite for those who are at the lower end of the table. Thus, leaderboards are often viewed critically as its use involves a certain risk of user's demotivation [22, 32, 33]. For example, Hanus and Fox [32] compared a gamified course using leaderboards and badges with a non-gamified course. Both courses had a similar curriculum. They found that the students in the gamified group were less motivated and engaged than those in the non-gamified group. The demotivation might be the result of an inappropriate gamification design of the leaderboards. Leaderboards provide limited places for a few players who can stand at the top of the leaderboard. One measure to avoid negative effects of leaderboards on motivation is to design team-score leaderboards instead of single-score displays. Team-scores require collaboration and community, which supports the feeling of social relatedness (i.e. team affiliation) [12]. Another measure that avoids the demotivation of lower-ranked scorers is to display only partial information e.g. TOP 5 scorers. Consequently, care has to be taken over a proper design of leaderboards [32–34].

3 Method

A vignette study was conducted with order pickers at different locations in a shipping company in Austria between March and May 2018. The shipping company chosen is a major player in the Austrian shipping market. We developed the questionnaire for the survey based on a literature review and pre-tested it with graduate part-time logistics students. Subsequently, we distributed the anonymous questionnaires to 17 full-time pickers in printed format to collect data about the acceptance of game elements in this specific context. The pickers had one week to complete the questionnaire. The response rate was 100%.

The questionnaire, which is presented in the Appendix, comprises a question with selection of criteria and statements which are rated on Likert scales [35]. The first part of the questionnaire deals with the characteristics and tasks of the job as a picker. The second part deals with motivational factors such as money or job security. In the third

part, two different options for gamified performance feedback were presented to address the mentioned risk of using game elements and to recognize any differences in the perception of these feedback options. Figure 1 shows the first option and represents a feedback feature based on individual performance, which includes the game elements points, badges, avatars, achievements, progress bars and a leaderboard. The second option, which can be found in Figure 2, is a feedback feature based on group performance, which includes the same game elements. Participants were asked prior the survey if they had ever heard anything about gamification. Since the topic was not known by the participants, we decided not to explain the concept and purpose of gamification prior to the questionnaire and not to use the term 'gamification' to prevent causing confusion. Instead, we informed the participants that the intention of the survey is to ask them about their main drivers of motivation and to rate two models for enhancement of motivation and engagement. We used descriptive statistics to evaluate the results.

4 Results

In total, 17 pickers completed the questionnaires with 16 male and one female respondent. The pickers had on average five years of work experience in their job. Six respondents had one to three years of work experience, ten had five to ten years of work experience and one had more than ten (i.e. 19) years of work experience. Eight respondents were between 31 and 40 years old. Five respondents were between 20 and 30 years old, three between 41 and 50 years old and one person was older than 51 years.

In logistics literature, it is agreed that order picking is evaluated as a highly monotonous job [15]. The results of our study show, that only the half of the respondents agree that their job is highly monotonous. In fact, eight out of 17 participants agreed that the pickers work routines are rather monotonous, compared to nine pickers who consider their daily tasks as diverse. When asked "How would you describe your workplace?", the five most applicable criteria were: accuracy at work (chosen by 14 respondents), tasks are repeated very often (monotonous tasks) (8 respondents), tasks are different and change often (7 respondents), enjoying work/fun at work (7 respondents) and working in teams (7 respondents).

When the respondents were asked "What is important for you at your workplace?", the following five criteria were most frequently rated as "very important": Appreciation & recognition (12 out of 16), good salary (13 out 17), good working environment (13 out of 17), safe workplace (10 out of 17) and reward (bonus, …) (9 out of 17). With five extrinsic motivators on top, results show that extrinsic motivators clearly outweigh intrinsic motivators in our survey group.

The evaluation of gamified feedback features for individual performance and team performance showed similar means. Both options achieved the same positive results in terms of creation of fun ($\mu = 2.82$) and increase of performance ($\mu = 3.29$). Team challenges and personal challenges were rated similarly ($\mu = 2.94$ compared to $\mu = 3.00$). Participants' preference of individual feedback over group feedback was marginal ($\mu = 2.82$ compared to $\mu = 3.00$). In addition, the participants evaluated a positive impact for gamified individual and group feedback on motivation ($\mu = 2.88$ compared to $\mu = 3.06$).

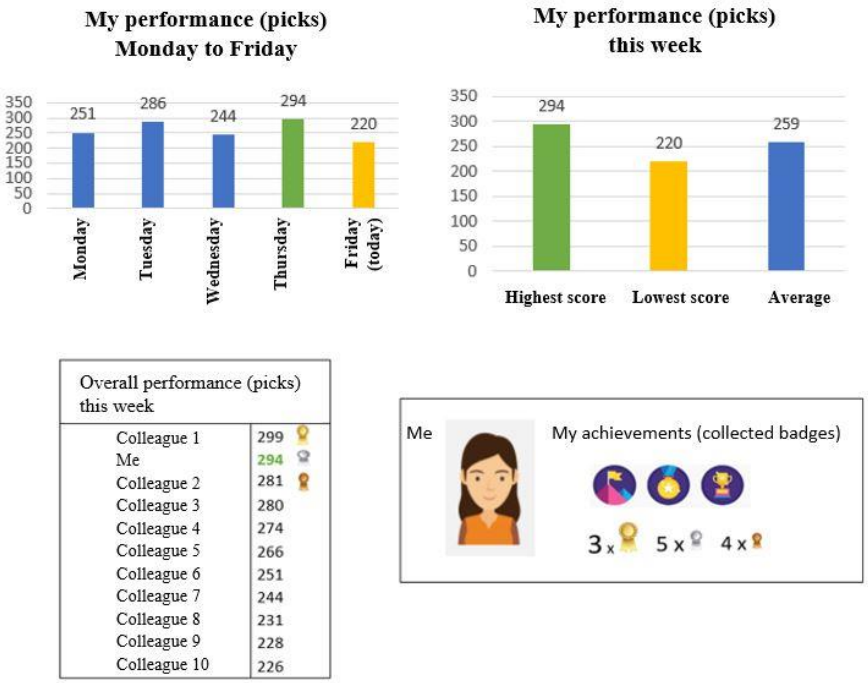

Fig. 1: Gamified feedback feature for individual performance. Adapted from [36]

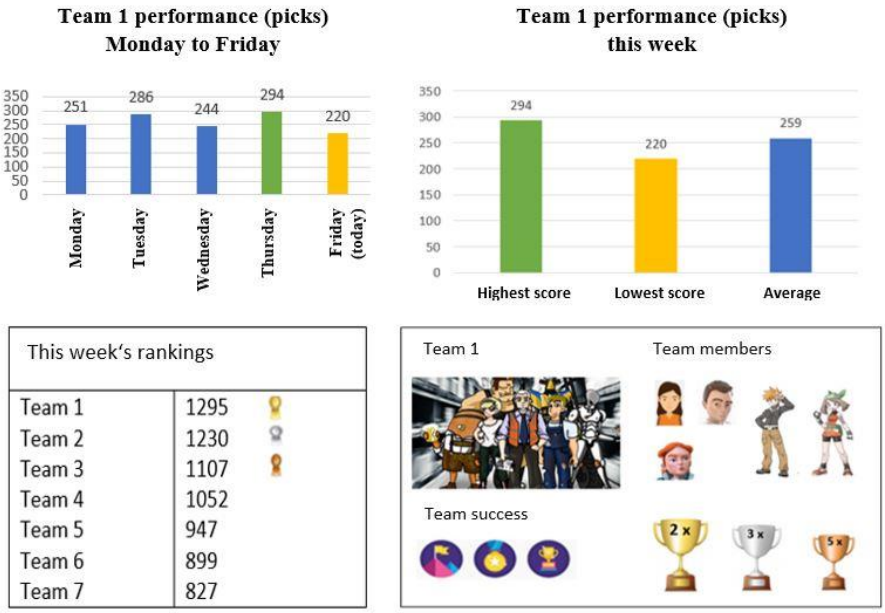

Fig. 2: Gamified feedback feature for team performance. Adapted from [36]

5 Conclusion, discussion and limitations

Order picking represents one of the most labour- and time-intensive processes and ,thus, resource-intense processes in internal logistics. However, the tasks of order pickers are highly monotonous which often results in demotivated staff, a high number of errors and thus, costs. Gamification, aimed at making the job more fun, might be one solution to overcome motivational problems of pickers and decrease error rates. Thus, the aim of this paper was to investigate acceptance of gamification by order pickers. Moreover, it was investigated if gamified performance feedback on an individual or group basis is preferred by the pickers. Results showed a positive evaluation for both individual and group performance feedback but no significant preference for one type. Empirical research for this result, as well as the reproducibility in larger study groups remains subject to future studies.

Based on the results of this vignette study, the use of gamification in the order-picking sector appears to be a suitable approach to promote motivation and performance of pickers. For future implementation of gamification in the workplace, it is crucial to raise acceptance for new approaches and methods such as gamification and to communicate the additional value gained through gamification also to the management level. To successfully implement gamification a clearly defined concept has to be established. When developing the concept, a common discourse with all people involved is needed. Another crucial point is that the gamified applications must not interfere with the work process and must not generate additional expenses for the employees. Similarly to [37, 38] we conclude that after the collection of all relevant information, gamification components such as scores, points and badges can be adapted to the participating person's interests and needs.

This study has several limitations which influence generalizability. A major limitation of this vignette study is the very small sample size with 17 respondents. However, due to the uniqueness of the sample composition and the topic of this study, we hope that the results are of interest for the gamification community. Further studies may use the underlying results as a starting point for in-depth investigation of the research topic. The study was only conducted at a single company in one country and results may not be transferred to other shipping companies or hold across other cultures. Moreover, several of the measurement scale items were slightly modified from their original and demonstrated formats in order to fit the specific purposes of this study.

Our study reveals multiple opportunities for future research. Future research might have a closer look at the implementation of other game elements for performance feedback in order-picking to identify the acceptance and suitability. Besides motivational effects, future studies should also address and measure psychological and behavioural outcomes to cover the full chain of the gamification process [7, 37]. Furthermore, studies should be done in various countries and companies with larger samples to verify the existing results. Additionally, it is of interest to conduct an empirical experiment and investigate the motivational and productivity effects of gamification for order pickers over a longer period. This could also give further insight into the current discussion in the literature about whether the novelty effect of gamification wears off [32, 39–42].

Qualitative interviews can be used to get a better understanding of the underlying motivational drivers of the order pickers.

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Appendix - Questionnaire

Dear employees,

Your opinion is important to us. We would like to ask you politely to complete this questionnaire as part of a scientific work. Please answer each question and statement and do not skip any. Therefore, please complete this questionnaire as conscientiously, honestly and completely as possible. There are no "right" and "wrong" answers to the questions included in this questionnaire.

The participation on this questionnaire is voluntary and anonymous. Your personal answers remain undisclosed.

Thank you for your participation.

Gender

O Female O Male

Age

[ ] Years

How long have you been working in the picking sector?

[ ] Years

1. How would you describe your workplace? [43]

Please tick the five most applicable criteria.

Tasks are repeated very often (monotonous tasks)	O
Tasks are different and change often	O
Simple tasks	O
Complicated tasks	O
Physical stress	O
I don't have to strain myself to concentrate	O
I have to strain myself to concentrate	O
Tasks under time pressure	O
Tasks without time pressure	O
Accuracy at work	O
Enjoying the work/Fun at work	O
Little to no fun at work	O
I often work alone	O
Working in teams	O
High frequency of new employees (fluctuation)	O
Often too little or to short training at the beginning of work	O
Little to no appreciation (recognition) for achievements	O

2. Order-picking tasks [43]

Please tick the applicable box.

My tasks in order-picking, …	Strongly agree						Strongly disagree
	1	2	3	4	5	6	7
… repeat themselves very often.	O	O	O	O	O	O	O
… are often changing and diverse.	O	O	O	O	O	O	O
… are executed manually (by hand).	O	O	O	O	O	O	O
… are easy to understand.	O	O	O	O	O	O	O
… are complicated.	O	O	O	O	O	O	O

Doing my tasks in order-picking, …	Strongly agree						Strongly disagree
	1	2	3	4	5	6	7
… I have to concentrate.	O	O	O	O	O	O	O
… I work under time pressure.	O	O	O	O	O	O	O
… I have to work precisely.	O	O	O	O	O	O	O
… no mistakes should happen.	O	O	O	O	O	O	O

3. What is important for you at your workplace? [6, 9, 44]

Please tick the applicable box.

	Very important	Important	Not so important	Not important
Good working environment	O	O	O	O
Safe workplace	O	O	O	O
Proximity to home	O	O	O	O
Further training opportunities	O	O	O	O
Career opportunities	O	O	O	O
Good salary	O	O	O	O
Appreciation, recognition	O	O	O	O
Fun at work	O	O	O	O
Reward (bonus, …)	O	O	O	O
Interesting tasks	O	O	O	O
Self-fulfilment (creativity)	O	O	O	O
Challenges	O	O	O	O
Flexible working hours	O	O	O	O
Feedback about my work performance	O	O	O	O
Structured workflows	O	O	O	O
Regulated division of labour	O	O	O	O

4. Feedback example for personal work performance

Please tick the applicable box.

Feedback on my performance as in the example below …	Strongly agree						Strongly disagree
	1	2	3	4	5	6	7
… is a good idea	O	O	O	O	O	O	O
… would motivate me in a positive way.	O	O	O	O	O	O	O
… brings fun to work.	O	O	O	O	O	O	O
… would be a positive personal challenge.	O	O	O	O	O	O	O
… would increase my performance.	O	O	O	O	O	O	O

5. Feedback example for team performance at work

Please tick the applicable box.

Feedback on team work as in the example below …	Strongly agree						Strongly disagree
	1	2	3	4	5	6	7
… is a good idea	O	O	O	O	O	O	O
… would motivate the team in a positive way.	O	O	O	O	O	O	O
… brings fun to work.	O	O	O	O	O	O	O
… would be a positive challenge for the team.	O	O	O	O	O	O	O
… would increase the team performance.	O	O	O	O	O	O	O

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