

Gamified Workshops as Drivers for Attitudinal and Behavioral Shifts toward Sustainable Business Practices: The Role of Enjoyment, Curiosity and External Regulation

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Abstract

Gamification has recently gained a great deal of attention in various research communities. The application of game elements in non-game contexts has shown a lot of potential and the expectations of researchers and businesses are high. However, few studies exist that empirically test the effectiveness of gamification applications in business settings. To fill this gap, we present results from workshops that promoted environmentally friendly business practices. 261 individuals participated in a study in which various gamification elements were applied. Our findings illustrate that enjoyment and curiosity, both of which are strongly fostered by gamification elements, exert a significant influence on individuals' attitudes and subsequently their behavioral intentions to adopt sustainable business practices. In contrast, the impact of external regulation turned out to be insignificant. The findings highlight the important role of enjoyment and curiosity for a sustainable change and bear important implications for academics and practitioners.

1. Introduction

Alarmed by the climate crisis as well as other negative environmental and societal impacts of industrialization on sustainability [29], various stakeholder groups exert substantial pressure on managers to adopt more sustainable business practices. Sustainability has thus become a crucial factor in management practice [18, 60] and IS researchers are considering strategies to actively create a positive impact [22]. Especially the cross-disciplinary field of Supply Chain Management (SCM) bears a lot of potential for pursuing sustainability goals. According to [60] “the need for environmental protection and increasing demands for natural resources are forcing firms to reconsider their

business models and restructure their supply chain operations” (p. 577).

Transport is the single research area within SCM that has the most significant environmental impact [17]. In 2014, the transport sector alone accounted for 23% of global CO₂ emissions and for 15% of overall greenhouse gas emissions [34]. Forecasts indicate that freight volume will quadruple by 2050 [48], which is expected to lead to further substantial increases of greenhouse gas emissions. A change in SCM professionals' attitudes and behaviors is therefore needed to incorporate sustainable transport modes such as railway and inland waterway transport in their supply chains and to enhance sustainable business practices. Today, in many companies an insufficient understanding exists about the potential benefits of sustainable governance [51].

Gamification, which can be defined as “the use of game elements in non-game settings” [15], is frequently used to motivate individuals to develop (new) skills and to change their behavior [33, 57]. In recent years, the application of gamification has become increasingly popular, with games or game elements being included in individuals' daily activities [41]. Gamification is used in fields as diverse as sports, health, sustainability, education, marketing, and business in order to address motivation and influence individuals' behaviors [6, 15]. [59] provided a framework on how gamification can be used for supply chain management education in order to increase students' level of engagement and enjoyment of the courses. [16] conducted a study in an operations research class and found that the percentage of successful students and students' participation in class increased. According to [30], individual's behavior and attitude toward environmental consciousness can be influenced by gamification. However, there is a dearth of empirical literature investigating gamified information systems in a business context and measuring their impact on individuals' attitudes and behaviors [42].

In this paper, we take one step to help to close this research gap and investigate the potential of gamification to impact attitudes and behaviors of aspiring SCM professionals. To ensure the comparability of the results, we follow the suggestions of [27] on how to design proper gamification studies. The goal of this paper is to examine the effects of enjoyment, curiosity and external regulation on attitude and behavioral intention within the context of sustainable supply chains. We target young business professionals from the transport industry in their role as future decision makers and use gamified workshops to trigger the desired changes. A quantitative survey in combination with structural equation modeling (SEM) is used to investigate the relationships between the constructs in the proposed research model.

In the following sections we first introduce the concept of gamification and identify relevant game elements [36]. Next, we discuss the theoretical background, the hypotheses and the research model. Then, we present and analyze the results of the model and, finally, we discuss potential implications for both researchers and practitioners as well as ideas for future research.

2. Literature review

To create and maintain sustainable supply chains, a change in SCM managers' attitudes and behaviors is needed. The academic literature offers a multitude of potential attitudinal and behavioral antecedents, with many scholarly papers highlighting the importance of individuals' motivation to ensure long-lasting change. Such a change can be achieved, for example, by applying various game elements [24].

2.1. Gamification to change attitude and behavior

In 1938, Huizinga claimed that individuals enhance their capabilities and knowledge by the process of playing and named his theory "homo ludens", which literally translates into "playing man" [31]. His key message is that humans learn through playing and that play is one of their main inner drivers. He focuses on the intrinsic motivation of free playing without a specific aim. Similarly, gamification builds on an individual's instinct to play. This desire can be used to change attitudes and to achieve a desired behavioral change. Previous research on gamification can be separated into psychological (e.g., attitude, enjoyment) and

behavioral consequences (e.g., intention to use), with most research so far being focused on behavioral outcomes [27]. Users have been shown to change behavior (e.g., increased participation) when applications are enriched with gamification elements [6, 24]. [52] demonstrated that an increase in motivation, which can be achieved through gamification, leads to improved performance. Using data of users of an online gamified exercise service, [26] found that enjoyment was directly and positively associated with continued use and that playfulness had an indirect effect. [39] used a gamified application to foster sustainable communities and concluded that "gamification principles are congruent with needed changes to educating individuals about sustainability issues" (p. 1498). Gamification has also been successfully used to support behavioral changes pertaining to the responsible use of electricity [28]. Since attitude is an important antecedent of behavioral intention [5], all attitudinal changes strongly influence subsequent behavior.

2.2. Enjoyment, curiosity and external regulation

The use of hedonically motivated information systems to boost productivity or to create value has recently received attention in IS research [43, 49]. In a hedonic environment, intrinsic motivation drives individuals' behavior, since they use a system or an application for intrinsic rewards such as enjoyment or pleasure instead of external rewards such as monetary gains [43]. Moreover, intrinsic motivation has been previously shown to be a strong predictor for the intention to use a hedonic information system [9, 54].

Enjoyment is an example of an intrinsic motivator [43] and describes an individual's perception of how entertaining, pleasurable, and fun a specific activity is [54]. Since games are intrinsically motivating, they can be seen as hedonic systems that people play for their own sake [41, 44]. Gamification refers to the process of enhancing services with game elements to increase value for participants [33] by combining both hedonic and utilitarian elements [25, 49]. Accordingly, [25] (p. 134) describe gamification as "where the goals of the systems' use are related to productivity, although the means and the design by which the systems promote productivity are hedonic in nature. Utilitarian games can hence be characterized as 'productivity through fun'." Enjoyment can thus be considered as an outcome of the process of flow [9, 46]: an innately positive experience, which is closely connected to feelings of enjoyment. Flow theory describes this state as an

individual's complete absorption and its manifold consequences [10].

Curiosity represents another element of intrinsic motivation [44]. It can be defined as “a positive emotional-motivational system associated with the recognition, pursuit, and self-regulation of novel and challenging opportunities” [37] (p. 291). Curiosity can thus be explained as a motivational state that increases engagement and leads to exploratory behavior. Therefore, enjoyment is not necessarily a prerequisite for curiosity [4], but both constructs have been shown to impact motivation [37, 43] as well as innovation adaption [45] and can be considered as intrinsic factors. Gamification aims to increase individuals' curiosity by enriching service, educational or work activities with game elements [25] [36], for example, by designing appealing game environments or by creating challenging tasks [36].

Both enjoyment and curiosity have the potential to increase intrinsic motivation. In order to also account for mandated use [56], we have included the construct “external regulation”, which refers to behavior that is regulated through external means. Although the motives for such behaviors might be different, obliging individuals to carry out specific activities is typical of most working environments. In an IS context, external regulation has previously been shown to exert a significant influence on subjective norm [8] and to positively influence the extent of open source software adoption [40].

3. Research hypotheses

A huge amount of IS literature exists that postulates a significant impact of enjoyment (or closely related constructs such as joy and playfulness) on individuals' attitudes and behavioral intentions [54][43]. Previous research has modeled attitude as a mediating variable between individual beliefs or evaluations and behavioral intention [13]. Accordingly, we model attitude as a mediator between enjoyment and behavioral intention, and hypothesize:

H1: *Enjoyment positively influences individuals' attitudes toward sustainable transport*

[32] initially modeled curiosity (together with enjoyment and concentration) as a reflective sub-dimension of attitude and subsequently in a decomposed structural model as a direct antecedent of attitude. Their results in a context of social networking sites show that in both cases a significant effect exists. Similarly, [38] modeled curiosity as a

sub-dimension of cognitive engagement and found a significant effect on attitude in their study about learner acceptance of a multimedia-based learning system. Thus we hypothesize a positive effect of curiosity on attitude:

H2: *Curiosity positively influences individuals' attitudes toward sustainable transport*

By definition, gamification appeals to individuals' inner urge to engage in activities that are playful. The IS community has previously differentiated between mandated and discretionary use [21]. Previous results on mandated use of technology differ, and [7], who tested a TAM model in the banking industry, concluded that their model “also does not fare well when usage is mandated” (p. 290). Given the somewhat contradictory notions of play and mandated use, we hypothesize:

H3: *External regulation negatively influences individuals' attitudes toward sustainable transport*

The positive link between attitude and behavioral intention has been postulated and tested numerous times as a part of theories such as the Theory of Reasoned Action [20], Theory of Planned Behavior [2] and the TAM [12]. This relationship has been confirmed through numerous empirical studies, independent of the underlying theory and the research design. Accordingly, we hypothesize:

H4: *Individuals' attitudes toward sustainable transport positively influence their intention to use them*

Figure 1 summarizes our hypotheses in a comprehensive yet parsimonious model that includes two intrinsic factors closely related to the playfulness of gamification (i.e., enjoyment, curiosity) as well as one construct representing mandated use (i.e., external regulation).

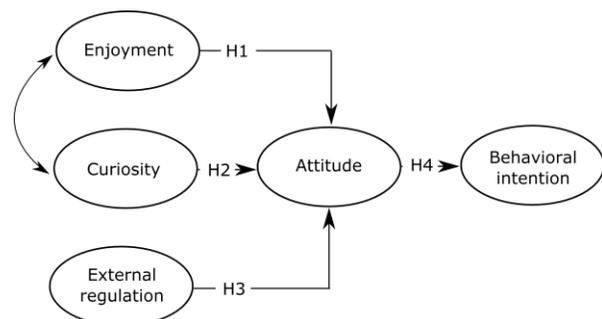


Figure 1. Research model

Furthermore, our research model exhibits a correlation between enjoyment and curiosity, which is based on logical considerations [3] as well as previous research findings [35]. Both constructs measure intrinsic phenomena and we therefore assume a strong correlation between them. Table 1 summarizes the model constructs and provides definitions as well as sources from the academic literature.

Table 1. Research model constructs and sources

Construct	Definition	Source
Enjoyment	The pleasurable aspects of the interaction described as being fun and enjoyable rather than boring	[1], p. 673
Curiosity	The extent the experience arouses an individual's sensory and cognitive curiosity	[1], p. 673
External regulation	External regulation occurs when behavior is regulated by rewards or in order to avoid negative consequences	[23], p. 177
Attitude	An individual's evaluation of the behavior of interest	[5] p. 254
Behavioral intention	A person's perceived likelihood or subjective probability that he or she will engage in a given behavior	[47]

4. Methodology

A quantitative survey was used to investigate the effects of the hypothesized relationships in the context of gamified workshops. The survey was designed to measure changes in attitudes and behavioral intention and the antecedents thereof.

4.1. Sampling

This study used gamified workshops to assess the effect of enjoyment, curiosity, and external regulations on attitudes and behavioral intentions, with the unit of analysis being SCM professionals in an apprenticeship. We identified the pool of potential respondents through desktop research into the leading SCM companies and educational institutions in Austria. In total, four vocational institutes that offer a part-time study program with a major in SCM for apprentices were identified and invited to participate in the study. All four institutes agreed to partake with at least one class of students who were in the second or third year. Thus, all the participants had at least one year of professional experience in the transport or supply chain sector. It was mandatory for the participants in the chosen classes to participate in the workshops. As far as experience and age is concerned, we strived to make the sample as

homogeneous as possible in order to avoid any confounding impact of these variables.

4.2. Measurement items

We used existing scales from the literature to ensure the validity and the comparability of the results. All survey items were assessed with either semantic differentials or seven-point Likert scales ranging from 1 (strongly agree) to 7 (strongly disagree). In order to account for the specific topic of the workshop (i.e., sustainable transport) several minor wording modifications had to be made. Additionally, pretests were conducted with individuals from the target group to ensure the understandability of the questions and the parsimony of the scales. Following these pretests, several items were eliminated based on judgmental criteria ("scale purification"), but no ex post modifications of the scales were made [58].

Our semantic differential scale for enjoyment (i.e., joy) was based on the five-item scale for joy from [43], who themselves built on substantial previous work. [55], for example, proposed a three-item scale and [54] used a semantic differential with four items. Our scale was designed to measure the level of enjoyment (dis)confirmation immediately after the workshop. In other words, the scale was intended to measure the (perceived) enjoyment of the gamified workshop. The three-item curiosity scale was also taken from [43], who adapted a scale by [1] to a gaming context. The external regulation scale stems from [23]. Based on the pretest, the original four items were reduced to two items which best convey the meaning of mandated use. The four-item attitude scale was taken without any modifications from [5] and the three items for measuring behavioral intention were taken from [53] with only slight modifications to match the context of this study. Table 2 summarizes the scales that were used in the gamified workshop and the respective sources.

Table 2. Measurement scales

Construct	Items	Source
Enjoyment	All things considered, the workshop was (1) enjoyable ... unenjoyable (2) interesting ... tedious (3) arousing ... boring (4) fun ... not fun	[1]
Curiosity	(1) This experience excited my curiosity (2) This experience made my curious (3) This experience aroused my imagination	[1]
External regulation	I was attending this workshop, (1) ... because I was supposed to do it	[23]

	(2) ... because it is something that I have to do	
Attitude	All things considered, using waterway inland transport is a ...	[5]
	(1) bad idea ... good idea	
	(2) foolish move ... wise move	
	(3) negative step ... positive step	
	(4) ineffective idea ... effective idea	
Behavioral intention	If I were a logistics manager ...	[53]
	(1) I would have the intention of using sustainable transport	
	(2) I would have the intention of using sustainable means for cargo transport	
	(3) I would have the intention of using sustainable transport frequently	

4.3. Data collection and analysis

Previous research on gamification can be categorized into behavioral and psychological outcomes [27]. In this study we investigate both outcomes using validated measurement instruments. The data collection took place between October 2015 and June 2016. In total, 261 SCM professionals participated in seven workshops that included identical gamification elements. For the purpose of this study, which was to investigate the effects of these gamified workshops on antecedents of attitudinal and behavioral change, primary data was gathered with questionnaires that were administered to the workshop participants immediately before and after their gamification experience. The data was collected completely anonymously in order to ensure the privacy of the participants and to avoid social desirability bias.

4.4. Game elements in the workshops

The workshops were organized as all-day events which took place at a major supply chain hub. The overall design of the workshops was standardized in order to minimize the confounding impact of the role of the workshop leader. They were designed in a competition format, whereby participants received points for correctly solving problems or work tasks. At the end of each workshop, the best team received a prize and a badge.

The main aim of the game elements in this study was to increase users' motivation to concentrate on a specific topic and to achieve a change in individuals' behavioral intentions [33]. The following game elements, which are based on [36], [52], [11], [24], [27] and [15], were used in the workshop:

- Clear goals: The participants knew exactly the aims of the overall workshop and each respective

task. They also knew the maximum number of points for each task.

- Immediate oral feedback: The participants learned immediately if they had found the correct solution or what the correct solution would have been otherwise.
- Leaderboard: The participants knew exactly how their team and the other teams were performing.
- Time constraint: For some tasks the participants had only limited time available to find solutions.
- Challenge & cooperation: The workshop was designed in the form of a competition; the teams received points for correct answers or good solutions. Participants needed to collaborate within the teams to be able to solve the tasks.
- Storytelling: The tasks were embedded in a story so the participants were motivated and got involved in this story.
- Rewards & badges: The best team received a prize, a picture of the winners and a badge, which was sent after the workshop. Rewards were used to externally motivate the participants.

At the beginning of the gamified workshop, the participants were informed about the schedule, the rules of the planned competition and the privacy of their personal information. Teams were formed and the participants had to remain in those teams for the entire day-long workshop. Each team was rewarded with a specified number of points for each task it successfully completed. The best team, measured in terms of the highest points tally, received a prize.

The schedule for the gamified workshop included five tasks: the first task was an interactive lecture on sustainable SCM from an industry expert with a focus on transport logistics. During the lecture, participants had to answer questions within two minutes (time constraint) where each team received points for the correct answer(s) (competition). The second task was to solve a transport calculation, which was limited to 25 minutes (time constraint) for the calculation and five minutes for the feedback (immediate feedback, competition). Next, a simulation game was embedded in a story (storytelling) before participants had to make their transport and transshipment decisions in real time. The next task was a container quiz, where time was limited again (time constraint) and participants were rewarded with points for correct solutions. The last task was called "future transport ideas". Participants had limited time (time constraint) to find future transport ideas and tell their story (storytelling).

Participants received additional points for fast and correct solutions, and for explaining their solution to the other teams. The scoring system was identical for

all gamified workshops and the participants were evaluated by the same people (researchers and representatives from the industry) in all workshops in order to ensure equal treatment.

5. Results

The data were analyzed with IBM SPSS Statistics 24 and IBM SPSS Amos 24.0.0. Apart from using descriptive statistics, we applied confirmatory factor analysis (CFA) and structural equation modeling (SEM), which are two of the most commonly used multivariate statistical methods in empirical research and are well accepted in the IS community. SEM is a method that is applied for the simultaneous testing of hypotheses which are based on theoretical models. Since the focus of this paper is on testing established models rather than theory development and our sample size exceeds the suggested threshold of 250 observations, we preferred a covariance-based over a variance-based (i.e., PLS) approach [50].

5.1. Descriptive results

In total 261 persons participated in the workshop and all of them filled out two surveys, which were administered immediately before and after the event (response rate: 100%). For the SEM analysis only the latter were used. Out of the participants, 161 (61.7%) were male and 100 (38.3%) female. All of them were in an apprenticeship program in a logistics company and attended, in parallel, a vocational training. The age range was from 15 to 44 years with a mean value of 18.73 and a standard deviation of 4.15. All of them worked at different operational and managerial levels in SCM and logistics in their respective companies and most of them were at the beginning of their professional career.

5.2. Measurement model assessment

To examine the reliability and validity of the scales we used confirmatory factor analysis. The composite reliability (CR) and the average variance extracted (AVE) can be found in Table 3. The CR values for attitude, enjoyment, curiosity and behavioral intention ranged from 0.88 to .0.93, indicating a high level of convergent validity. Similarly, their AVE was well above the recommended threshold of 0.5. In the case of external regulation, however, the standardized loading was larger than one and the error variance was negative, which resulted in a so-called Heywood case [14]. The results for er1 thus have no meaning. We therefore

equated the factor loadings of the two indicators of this latent variable and the result was satisfactory (er2). However, the initial results indicated a severe problem with the external regulation scale and care should be taken when interpreting the impact of this scale.

Discriminant validity was assessed by comparing the correlations among constructs with the square root of the AVEs (as shown in bold as the diagonal of Table 3) and examining the cross-loadings among items and constructs. The square roots of the AVE exceeded the correlations and the rotated cross-loadings were smaller than the factor loadings of each item, indicating sufficient discriminant validity. Common method bias (CMB), which was measured according to Harman's one factor approach, turned out not to be a major problem in this study.

Table 3. Reliability and validity measures

	CR	AVE	att	enj	cur	bi	er
att	0.91	0.71	0.844				
enj	0.88	0.66	0.530	0.811			
cur	0.91	0.76	0.557	0.662	0.873		
bi	0.93	0.81	0.718	0.481	0.559	0.897	
er1	12.7	19.3	0.009	0.019	0.015	0.018	4.395
er2	.72	.56	0.034	-0.01	-0.06	0.041	0.748

5.3. Structural model assessment

The fit of the structural model was satisfactory (RMSEA = .074; CFI = .948; TLI = .928) and the results lend partial support to our model. The two constructs enjoyment ($\beta = .29$, $p < .001$) and curiosity ($\beta = .39$, $p < .001$), which are closely related to the hedonic and motivational aspects of gamification, had a significant positive effect on attitude (see Figure 2). Even though student participation in the workshops was mandatory, the effect of external regulation was insignificant ($\beta = .06$), which is in line with the measurement problems of the construct that we experienced. Additionally, the constructs enjoyment and curiosity were strongly correlated ($r = .66$, $p < .001$). The relationship between attitude and behavioral intention turned also out to be highly significant ($\beta = .73$, $p < .001$). With R^2 values of 39% for attitude and 54% for behavioral intention, our model has a substantial amount of explanatory power.

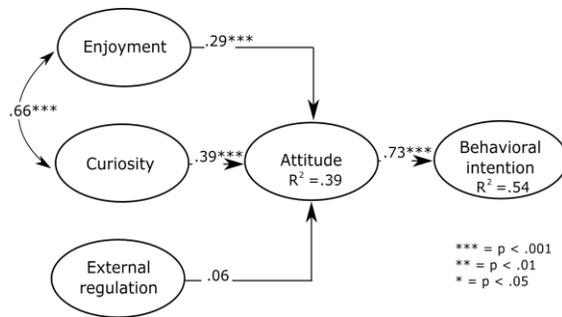


Figure 2. SEM results

5.4. Impact of the workshops

The results above highlight the important influence of various attitudinal and behavioral antecedents in a gamified workshop setting. In order to account for actual changes in attitude and behavior, we measured these constructs immediately before and after the workshop. Again, we used a 7-point Likert scale with 1 indicating the highest level of agreement and 7 the lowest. It turned out that the attitude of the participants prior to the workshop was already fairly positive ($\mu = 2.23$, $\sigma = 1.09$), but this value even increased immediately after the workshop ($\mu = 2.05$, $\sigma = 1.03$). Since the data was not normally distributed, a non-parametric Wilcoxon signed-rank test was conducted and showed a statistically significant difference in students' attitude ($Z = -2.51$, $p < .01$). Similarly, the intention to use sustainable transport increased from a mean value of 3.15 ($\sigma = 1.43$) to 2.45 ($\sigma = 1.38$). The Wilcoxon signed-rank test was also significant ($Z = -7.35$, $p < 0.01$).

6. Discussion and implications

In this study we hypothesized a positive impact of intrinsic factors, being measured with the previously validated constructs "enjoyment" and "curiosity", on individuals' attitude and behavioral intention to adopt sustainable business practices. Furthermore, we included the construct "external regulation" to account for mandatory participation in the gamified workshops. The empirical results from a study of 261 SCM professionals who are currently in an apprenticeship scheme and receive on-the-job training confirmed our hypotheses that enjoyment and curiosity contribute to a positive change in attitudes and subsequently also in behavioral intentions. The effect of "external regulation" on attitude turned out to be insignificant, which is remarkable since all participants had to attend the workshops as part of their training program. The high

correlation between curiosity and enjoyment can be explained by the setting of workshops, in which a positive learning atmosphere was created and the intellectual capabilities of the participants were challenged.

6.1. Theoretical implications

The results of our study confirm the validity of the measurement scales with the single exception of the construct "external regulation". The slight modifications of the scales which we undertook were done ex ante and based on several rounds of pretesting. These modified scales provide new measurement tools for researchers who want to investigate phenomena in the context of sustainable SCM systems. Our parsimonious model can easily be extended to account for other constructs pertaining to extrinsic and intrinsic motivational factors.

As far as theory development is concerned, our study builds on previous attitudinal and behavioral research and applies it to the specific context of gamified information systems. It thus supports the theoretical underpinning of gamification studies.

6.2. Managerial implications

This study was conducted with (aspiring) SCM professionals, many of whom will take their place in management in the years to come. It is therefore crucial to know how their attitudes and behavioral intentions can be shaped in an early stage of their career. This study clearly had a normative aspect, since sustainable transport practices are superior to traditional transport systems when it comes to the overall environmental impact. Thus, it was interesting to see how gamification elements which were incorporated into the workshop design were able to positively impact participants' attitudes and intentions. Future workshop designers (as well as researchers) can benefit from our findings by designing workshops in ways which increase enjoyment and create curiosity. This can be done, as we have shown in this study, by including game elements such as clear goals, immediate feedback, leaderboards, time constraints, challenges & cooperation, storytelling and rewards & badges. Since gamification supports behavioral change, it can easily be incorporated into educational and training programs that promote sustainable business practices.

7. Limitations and future research

Our model provides useful results regarding the importance of intrinsic motivating factors, which are triggered by gamified workshops. However, the initial results highlighted some problems with the measurement of “external regulations”, which deserve further attention. A so-called Heywood case refers to a situation in which the communality for a measured variable accounted for by the common factor is estimated to be at 1 or even greater. Such a situation may indicate a misspecification of the model or violations of the assumptions of the common factor model [19]. Further research is needed in order to detect to what extent mandatory attendance has an impact on the perception and success of gamified workshops.

The data sets which we present in this paper were collected immediately before and after the workshop, with the SEM model using the latter and the scales referring to individuals’ perceptions of the game elements. A more elaborate experimental design with different control groups would help to shed light on the impact and the durability of attitudinal and behavioral changes. Furthermore, although we tried to standardize the design of the workshops as much as possible, the role of the instructor also deserves further attention.

Finally, we acknowledge that, in addition to enjoyment and curiosity, individuals can also have additional antecedents of behavioral change and the results might differ for participants from different age groups and with varying levels of professional expertise. Future research should therefore include and test further constructs, many of which can be found in the existing literature. The scope of this study was limited to the application of gamification to trigger attitudinal and behavioral changes in the sustainable transport industry, which in turn will lead to more environmentally friendly business practices, and we hope that other researchers will replicate the findings of our study in different industries. This will not only foster the application of gamification to create change, but also support the transfer of research results into practice.

8. References

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