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Applying persuasive techniques in an online learning environment: A mixed-method study

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ABSTRACT

Persuasion is inherent to the instructional process. Instructions delivered through online programs do not always generate expected and consistent learning outcomes, and hence persuasion in online instructional design is even more critical. Through this mixed-method study, we aim to identify the most widely used persuasive design techniques, the challenges limiting their applications, and their implications. Furthermore, this paper discusses the recommendations of new persuasive techniques put forth by Instructional Designers.

Keywords: persuasive designs, mixed-method research design, online learning environment, challenges in applying persuasive design techniques, instructional/learning designers

INTRODUCTION

Persuasion is inherent to the instructional process. It is an essential element in teaching and instruction, the process of changing learners' perspectives about a given topic or changing their behavior by altering their underlying knowledge, or beliefs in the topic involved. Since instructions delivered through online programs do not always generate expected and consistent learning outcomes, persuasion in online instructional design is even more critical. According to Fogg (2009, p. 1-7) integrating persuasion techniques in the instructional design process can result in generating desirable learning outcomes like how it has been producing results in other areas such as marketing, web-based commerce platforms, mobile applications, and so on.

WHAT ARE PERSUASIVE TECHNIQUES?

Miller (1980, p. 11) defined persuasion as an interactive process through which a given message alters an individual's perspective by changing the knowledge, beliefs, or interests that underlie that perspective. Petty and Cacioppo (1986, p. 123-205) in their Elaboration Likelihood Model posited the two major routes to persuasion: the central route and peripheral route. A person taking the central route uses their cognitive functions and considers the merits of the presented content. To them, a clear well-argued message is very persuasive. On the other hand, someone choosing the peripheral route employs non-cognitive factors such as the emotional impact of the message, its visual representation, and the credibility of the messenger which is unrelated to the logical quality of the message. In simple terms, the personality of the person delivering a message can persuade this listener. According to Fogg's Behavior Model (FBM), the process to persuade someone to perform the desired behavior focuses on three main factors: increasing motivation, increasing abilities, and using triggers to prompt action. Based on the above two models, one can infer that a persuasive process is not only limited to the quality of the content being communicated but also includes the content's capacity to motivate people and their ability to act.

Outcomes/Benefits of using Persuasive Techniques

Fogg's FBM framework provides a framework to understand persuasive technology. Nevertheless, this model does not explain in detail the implementation strategies. To overcome the limitation in FBM, Oinas-Kukkonen et al. (2017, 2019, 2021b) adopted Fogg's FBM and formulated a Persuasive System Design (PSD) suggesting four main categories in the persuasion process - primary task support, dialogue support, system credibility, and social support. The model suggests seven design principles under each of the four categories, thus totaling 28 design principles. Nor Aziah Daud, and the team worked on the weaknesses of the PSD model and adapted its design to persuade adult learners in a web-based learning (WBL) environment (Daud et al., 2013; Kasali et al., 2017). This persuasive model for the WBL environment has a total of 23 components falling under 3 main categories - primary task support, credibility support, and learning support. The two components, Primary Task Support and Credibility Support are

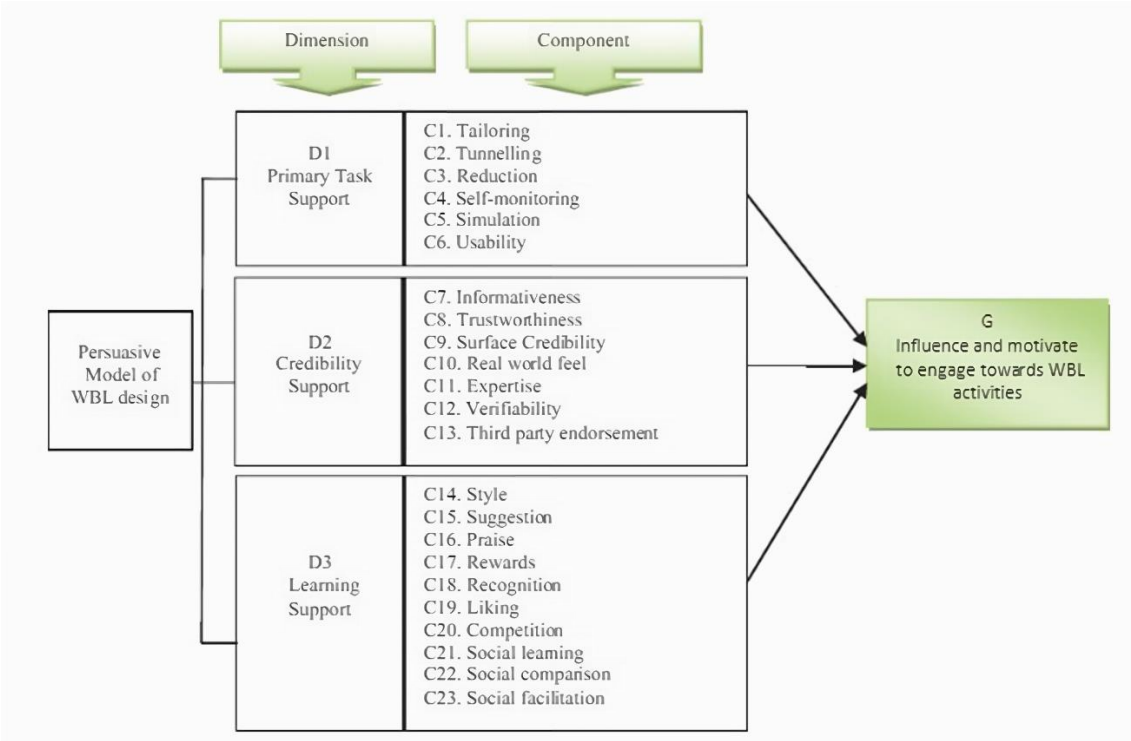

Figure 1. Initial persuasive model of a web-based learning design (Adapted from Daud et al., 2015)

Table 1. Primary task support–design principles

Design principle	Description
Tailoring	Tailoring information to the potential needs, interests, personality, usage context, or other factors relevant to a learner group.
Tunneling	Persuading learners using the system by guiding users through a process or experience.
Reduction	Reducing complex behavior into simple tasks, thereby enabling learners to perform the desired behavior.
Self-monitoring	Helping learners keep track of their own performance or status and supporting them to achieve their goals.
Simulation	Enabling learners to observe the link between cause and effect by providing learning through simulations.
Usability	Creating more usable and accessible learning content.

Table 2. Credibility support–design principles

Design principles	Description
Informativeness	Providing useful, timely, and sufficient information.
Trustworthiness	Providing truthful, unbiased, and fair information will be perceived as trustworthy.
Surface-credibility	Focusing on the competent look and feel of the learning system.
Real-world feel	Providing details about the actual people or real-world examples related to the learning contents.
Expertise	Providing information exhibiting knowledge, experience, and competence.
Verifiability	Providing a means to verify the accuracy of information through external sources.
Third-party endorsements	Providing endorsements from well-known and respected sources to boost learners' perceptions.

included based on their success in PSD. The third component of Learning Support is a combination of Dialog Support and Social support. **Figure 1** depicts initial persuasive model of a WBL design.

Primary Task Support

The six design principles in the Primary Task Support category (Oduor et al., 2019) support learners to perform the primary task (**Table 1**).

Credibility Support

The seven design principles in the credibility support describe the designing practices for a credible system (**Table 2**).

Learning Support

The ten design principles layout techniques to offer positive feedback to learners and motivate them by leveraging social influence (**Table 3**).

In addition to suggesting the 23 design principles, this model provides details on how each of the components can be implemented for WBL (**Table 4**).

Table 3. Learning support–design principles

Design principles	Description
Style	Providing information to support learners' multiple learning styles.
Suggestion	Offering fitting suggestions to learners.
Praise	Offering praises to learners through words, sounds or images to provide feedback for their behaviors.
Rewards	Rewarding learners virtually to give credit to their work.
Recognition	Providing public recognition for learners performing the target behavior.
Liking	Developing relevant information for learners to align with their likings.
Competition	Offering options for learners to compete with other learners.
Social learning	Providing opportunities to observe other users and learn from them.
Social comparison	Providing the means for comparing learner performance with that of the other learners.
Social facilitation	Providing opportunities for learners to observe the other learners (who might be performing the target behavior).

Table 4. Techniques to implement the web-based learning design principles

Implementation techniques
E1. Content for adult learners (andragogy).
E2. Guide learning process (theory, video, question, and answer).
E3. Simplifying in sequence topic.
E4. Measure own performance (graph, time).
E5. Assessment before and after.
E7. Useful, sufficient, timely.
E8. Correct, equitable, unbiased.
E9. Clear layout, consistent graphics/images/typography, avoid misspelling, grammatical errors, excessive marketing element.
E10. Contact information (name, position, email, telephone, address, web address, photo, biography), appropriate background.
E11. Provide background information, video from experts and communication spaces with experts.
E12. Links to external resources, references to scientific publications, clear expert's references, accurate resources.
E13. Related logos (High Education Ministry).
E14. Learning style (visual, auditory, kinesthetic).
E15. Syllabus, learning schedule, learning approach.
E16. Automatic prompts.
E17. Words, sounds, symbols, visual.
E18. List of top learners, chart of website's success.
E19. Relevant visual.
E20. Online competitions.
E21. Interaction method (list of email, chat room, discussion forum, journals/articles).
E22. Comparison method (frequency of learners visit, the most active learners, the highest evaluation).
E23. Observation method (shows learners referring the same topic, doing quiz).

Table 5. Persuasive design principles employed in secure comics

Categories	Principles
Primary task support	Tailoring, reduction, self-monitoring, usability
Credibility support	Real-world feel, informativeness
Learning support	Style, suggestion, social learning

Our study also discovered the importance of integrating emotions into the instructional design to improve participants' emotional affordability in an online learning environment. Park and Lim (2019, p. 53-67) through their study suggested that online learning environments should reflect the principles of positivity, playfulness, humanity, self-disclosure, safety, personalization, affinity, and intimacy for enhancing the emotional meaning and context for learners.

Applications of Persuasive Design Techniques

The evaluation of several learning programs developed based on the persuasive design (PD) techniques has shown to positively influence learners with higher motivation and engagement leading them to adopt the targeted behavior (Barari et al., 2020; Devincenzi et al., 2017).

Secure comics (Zhang-Kennedy et al., 2016, p. 215-257) is an online interactive comic series developed using PD principles to persuade adult learners to practice good computer security. This program employed persuasive techniques from all the three categories developed in WBL. The techniques employed under each of the categories are shown in **Table 5**.

User studies and evaluation of secure comics showed an improvement in user comprehension and learning effectiveness with a reduced cognitive load.

Impact of Applying PD in Education

Several research studies were conducted to evaluate the efficacy of applying persuasive techniques in the education environment. The EuroPLOT (Persuasive Learning Objects and Technologies) project conducted in the year 2010-2013 embedded persuasive concepts into the developed learning tools. The tools were evaluated in four case studies, covering different learning styles, and learning groups and the results indicated a wide range of success with PD (Behringer et al., 2013).

Table 6. Persuasive design techniques used in the survey

Categories	Principles	Techniques
Primary task support	Tunneling	TOC, visual map of a course, help buttons and chatbots
	Reduction	Multiple learning paths
	Tailoring	Interactive scenario-based learning material, include AR/VR technologies, options to choose from multiple mediums for contents
	Self-monitoring	Reflection questions, analytics on tests, tools for time management, progress bars to notify the level of completion
Building credibility	Trustworthy, expertise, surface credibility, real-world feel	High-quality multimedia, links for references, using examples & non-examples to explain
Learning support	Style	Using visual cues to draw attention
	Social learning	Discussion forum, chat rooms
	Recognition, reward	Leaderboard displays, award badges, stickers
	Intervening	Guiding learners to appropriate course contents, generating just-in-time recommendation
Emotional affordability	Playfulness	Designing content using humor
	Humanity	Allowing learners to provide anonymous reviews
	Safety	Convey content through human-like characters with facial expression

Goh et al. (2012, p. 624-640) investigated the impact of persuasive short messaging service (SMS) on students' self-regulated learning strategies. The study findings revealed that students who were intervened through SMS performed significantly better than those who did not receive it. The team also studied the effectiveness of persuasive SMS in students' self-regulated learning.

The HANDS project (Mintz & Aagard, 2012, p. 483-499) developed a mobile application using the following persuasive techniques: personalization, suggestion, reduction, self-monitoring, and tunneling. The application was designed to influence positive behavior change in adolescents with an autistic spectrum disorder. The project concluded that PD has the potential to foster positive behavior and attitude change in school settings.

By applying the gamification design, Arendt et al. (2014) educated and informed learners about the effective cooling methods for heat reduction in residences. Petersen et al. (2014, p. 79-87) developed a solution to engage, motivate and empower environmental thoughts and action in learners through socio-technical feedback. Other research (Bouchrika et.al., 2019) has revealed the value of gamification in persuading users to adopt, interact and engage better with educational systems.

RESEARCH METHOD

PD literature suggests that these principles can be applied across,

(a) multiple areas (social, health, environment, education, etc.),

(b) wide range of learners (children, adolescents, adults, learners in the autistic spectrum, etc.), and

(c) varied technologies (mobile application, game-based, informal dialogue-based, etc.).

Not many studies were conducted to evaluate the impact of PDs in video-based or WBL programs. The first step in overcoming this gap is to identify the PD techniques that are currently employed by instructional designers (IDs) in an e-learning environment. In this study, we aim to determine the frequently and rarely used PD techniques. Furthermore, we also aim to understand the challenges involved in adopting PD techniques. We believe the results of this study will provide insights for IDs and other learning program sponsors on the relationship between PD techniques, the industry of work, and IDs' work experience. This knowledge can help them identify effective PD techniques used across industries for developing online learning solutions and uncover the obstacles thwarting IDs from using certain PDs.

We began our mixed-method study by conducting a literature review to identify the PD principles and the techniques employed in applying the design principles in an online learning environment. After synthesizing a list of PD principles, we designed a survey to address the research question.

Research question: What are the barriers for IDs in applying PD techniques? The above question aims to uncover answers for the following topics:

1. Frequency of applying the identified PD techniques.
2. Challenges involved in implementing certain PDs over others.
3. Recommendations for new PD techniques based on IDs experience.

Survey Tool and Distribution

Inspired by the WBL model and the work done by Park and Lim (2109) on emotional affordances, a 14-question survey was developed using Qualtrics. The first 10 questions represented PD principles with more than one technique of implementing them in an online environment. Under the four main categories of primary task support, building credibility, learning support, and emotional affordability, multiple PD principles and 26 different techniques for applying them are mentioned in the survey. The PD techniques refer to the multiple ways of implementing a particular principle. For example, the principle of tunneling can be implemented through the following techniques: table of contents, a visual tour of the course, and help buttons. **Table 6** shows the PD techniques used in the survey.

Table 7. Survey participant count

Years of experience	Corporate	Higher-Ed	Non-profit	Others	Total
0 – 3+ years	8	3	1	1	13
4 – 8+ years	8	7	0	1	16
9 – 14+ years	3	2	0	3	8
14+ years	5	7	2	2	16
Total	24	19	3	7	**53**

Participants were asked to choose the frequency of using a particular implementation technique in their work. To choose the frequency, participants select their option from a five-point Likert scale with values ranging from always to never. In addition to the nine Likert scale questions, the survey consisted of two open-ended questions. These text-entry questions were designed to gather IDs' challenges in using any of the above-mentioned design techniques, and their recommendations for any new PD techniques. The final three questions were included to capture the demographic characteristics of the respondents. Refer to **Appendix A** for the list of questions.

This survey was distributed through social media platforms and emails to multiple forums and communities hosted specifically for instructional and learning experience designers. Our aim was to reach at least 70 people from multiple industries such as corporate, higher-ed, non-profit, and other sectors. So, we targeted forums with good ID representations from several industries and sent participants the online link to the survey.

DATA ANALYSIS

A total of 96 IDs participated in the survey out of which 54 responses were complete. A participant response is considered complete when all the nine Likert-style questions were answered. The two open-ended questions were optional for the purpose of survey completion. The 42 incomplete responses were discarded as a part of the data cleaning process. The focus of this study is on adult learners, therefore, only responses from IDs developing learning programs for adults are included. ID responses from the K-12 sector were deleted, bringing the total number of responses to 53. The 53 participant responses were used for further analysis. In this mixed-method study, sample data is analyzed both quantitatively and qualitatively.

Sample Data

Our sample data includes IDs across multiple industries and experience levels. The bi-variate **Table 7** gives the exact number of participants across years of experience and industries. The sample data was analyzed both quantitatively and qualitatively.

Quantitative Analysis

The first 12 questions in the survey were designed to collect quantitative data through Likert-style and multiple-choice questions. By analyzing the quantitative data of the survey, we hope to gather insights into what PD techniques IDs find engaging with their learners. Furthermore, we plan to look for any associations between PD technique usage and participants' industry of work, (i.e.) to discover if any design technique is more adopted in the corporate world in comparison to the higher-ed industry.

Figure 2 shows the frequency of PD techniques usage across industries. Similarly, **Figure 3** shows the frequency of PD techniques usage across IDs years of experience.

Frequency of the application of Design Techniques in elearning courses																											
Design Principles and Application Techniques		Always					Frequently					Occassionally					Rarely					Never					
		Industry					Industry					Industry					Industry					Industry					
		High-Ed	Corporate	Nonprofit	Others		High-Ed	Corporate	Nonprofit	Others		High-Ed	Corporate	Nonprofit	Others		High-Ed	Corporate	Nonprofit	Others		High-Ed	Corporate	Nonprofit	Others	
DT 1	Technique 1	5	5	0	1		4	4	0	0		4	3	1	2		2	6	2	2		4	6	0	2	
Guide	Technique 2	4	1	0	0		5	6	2	0		2	5	0	5		6	11	0	1		2	1	1	1	
Learners	Technique 3	12	13	1	4		5	9	1	1		1	0	1	0		0	2	0	2		1	0	0	0	
Total		21	19	1	5		14	19	3	1		7	8	2	7		8	19	2	5		7	7	1	3	
DT 2																											
Reduce																											
Complexity	Technique 1	5	3	0	2		4	7	0	2		7	6	1	2		3	8	2	0		0	0	0	1	
Total		5	3	0	2		4	7	0	2		7	6	1	2		3	8	2	0		0	0	0	1	
DT 3	Technique 1	9	10	0	2		7	12	2	3		3	2	1	2		0	0	0	0		0	0	0	0	
Build																											
Credibility	Technique 2	10	4	0	2		5	12	2	3		4	6	0	0		0	2	0	2		0	0	1	0	
Total		19	14	0	4		12	24	4	6		7	8	1	2		0	2	0	2		0	0	1	0	
DT 4	Technique 1	5	2	0	0		10	2	1	1		2	11	0	2		1	7	1	3		1	2	1	1	
Social	Technique 2	1	1	2	0		1	2	0	0		2	5	1	1		4	7	0	4		11	9	0	2	
Total		6	3	2	0		11	4	1	1		4	16	1	3		5	14	1	7		12	11	1	3	
DT 5	Technique 1	3	1	0	0		2	7	1	2		8	7	0	3		2	5	0	1		4	4	2	1	
Intervene	Technique 2	2	2	0	0		4	7	1	1		3	8	0	4		4	5	0	1		6	2	2	1	
Learners	Technique 3	13	17	2	4		3	7	1	3		2	0	0	0		0	0	0	0		1	0	0	0	
Total		15	19	2	4		7	14	2	4		5	8	0	4		4	5	0	1		7	2	2	1	
DT 6																											
Reinforce	Technique1	0	0	1	0		0	2	0	1		3	6	3	6		2	3	3	3		8	5	1	6	
Total		0	0	1	0		0	2	0	1		3	6	3	6		2	3	3	3		8	5	1	6	
	Technique 1	3	4	1	1		8	15	1	4		8	3	1	1		0	2	0	0		0	0	0	0	
	Technique 2	8	11	1	4		10	10	1	2		1	2	1	1		0	1	0	0		0	0	0	0	
DT 7	Technique 3	2	3	0	1		7	13	3	3		9	6	0	1		1	0	0	2		0	1	0	0	
Personalize	Technique 4	1	0	0	0		0	2	0	1		3	3	0	1		6	6	1	1		9	13	2	4	
learning	Technique 5	9	2	0	2		5	8	1	0		4	6	1	3		0	4	1	0		1	4	0	2	
	Technique 6	9	2	0	1		6	6	2	2		2	2	1	0		1	7	0	2		1	7	0	2	
Total		32	22	2	9		36	54	8	12		27	22	4	7		8	20	2	5		11	25	2	8	
DT 8	Technique 1	12	9	1	1		3	5	1	1		0	3	0	3		2	3	1	1		2	3	0	1	
Room for	Technique 2	1	1	0	0		3	9	1	2		7	6	2	3		5	6	0	2		3	2	0	0	
emotional	Technique 3	3	1	1	1		4	4	1	2		6	4	1	0		4	6	0	4		2	9	0	0	
expressions	Technique 4	0	3	0	1		6	8	0	2		6	2	2	2		3	9	1	1		4	2	0	1	
	Technique 5	1	0	0	0		5	1	1	0		4	5	0	0		2	9	0	1		7	9	2	6	
	Technique 6	0	3	0	0		6	10	2	1		5	4	1	2		5	4	0	3		3	3	0	1	
Total		5	8	1	2		24	32	5	7		28	21	6	7		19	34	1	11		19	25	2	8	
DT 9	Technique 1	0	0	0	0		8	13	1	1		4	6	2	4		3	5	0	0		4	0	0	2	
Self-	Technique 2	6	10	2	1		5	9	0	3		3	3	1	2		3	2	0	1		2	0	0	0	
monitor	Technique 3	3	11	0	1		7	5	1	1		8	5	1	3		0	2	0	1		1	1	1	1	
Total		9	21	2	2		12	14	1	4		11	8	2	5		3	4	0	2		3	1	1	1	
Overall Total		239	228	23	57		253	365	51	80		210	222	42	96		111	231	23	74		144	159	24	66	

Figure 2. Frequency of PD techniques usage across industries (Source: Authors' own elaboration)

Design Techniques (DT) and Techniques		Frequency of applying Design Techniques in elearnign courses																									
		Always				Frequently				Occassionally				Rarely				Never									
		Experience in years				Experience in years				Experience in years				Experience in years				Experience in years									
		0 to 3	4 to 8	9 to 14	14+	0 to 3	4 to 8	9 to 14	14+	0 to 3	4 to 8	9 to 14	14+	0 to 3	4 to 8	9 to 14	14+	0 to 3	4 to 8	9 to 14	14+						
DT 1 Guide Learners	Technique 1	10	8	0	1	1	7	2	0	0	1	0	1	2	0	4	4	0	0	2	10						
	Technique 2	1	0	0	2	2	9	1	5	4	3	3	2	3	2	3	6	3	2	1	1						
	Technique 3	3	4	0	4	1	3	2	2	2	2	3	3	1	5	2	4	6	2	1	3						
Total		14	12	0	7	4	19	5	7	6	6	6	6	6	7	9	14	9	4	4	14						
DT 2 Reduce Complexity	Technique 1	4	2	3	1	3	4	3	3	2	6	2	6	4	4	0	5	0	0	0	1						
Total		4	2	3	1	3	4	3	3	2	6	2	6	4	4	0	5	0	0	0	1						
DT 3 Build Credibility	Technique 1	5	7	3	6	7	6	4	7	1	3	1	3	0	0	0	0	0	0	0	0						
	Technique 2	4	5	2	5	4	7	5	6	4	3	1	3	1	1	0	2	0	0	0	0						
Total		9	12	5	11	11	13	9	13	5	6	2	6	1	1	0	2	0	0	0	0						
DT 4 Social Learning	Technique 1	2	3	1	1	2	4	4	4	3	7	1	4	3	2	2	5	3	0	0	2						
	Technique 2	0	2	0	0	1	0	2	0	2	2	2	3	1	7	3	4	9	5	1	9						
Total		2	5	1	1	3	4	6	4	5	9	3	7	4	9	5	9	12	5	1	11						
DT 5 Intervene Learners	Technique 1	1	0	2	1	2	6	2	1	3	6	3	7	2	3	1	2	5	1	0	5						
	Technique 2	2	1	1	0	1	4	4	4	4	4	2	5	1	6	1	2	5	1	0	5						
	Technique 3	9	12	6	9	4	3	2	5	0	1	0	1	0	0	0	0	0	0	0	1						
DT 6	Technique1	0	0	1	0	0	2	0	1	3	6	3	5	2	3	3	3	8	5	1	6						
Total		0	0	1	0	0	2	0	1	3	6	3	5	2	3	3	3	8	5	1	6						
DT 7 Personalize learning	Technique 1	3	2	0	2	2	13	0	7	6	0	1	6	1	1	5	1	0	0	2	0						
	Technique 2	6	8	2	8	5	8	5	5	1	0	1	3	1	0	0	0	0	0	0	0						
	Technique 3	2	2	1	1	6	8	5	8	3	5	2	6	1	1	0	1	1	0	0	0						
	Technique 4	1	0	0	0	1	1	0	1	2	1	2	2	3	6	2	3	6	8	4	10						
	Technique 5	4	5	0	4	2	4	2	6	2	5	4	3	3	1	1	0	2	1	1	3						
	Technique 6	3	4	1	4	4	5	3	4	1	2	1	1	3	2	1	4	2	3	2	3						
Total		19	21	4	19	20	39	15	31	15	13	11	21	12	11	9	9	11	12	9	16						
DT 8 Room for emotional expressions	Technique 1	5	8	1	10	1	4	3	2	1	2	2	1	3	2	1	1	3	0	1	2						
	Technique 2	0	0	0	2	3	5	4	3	4	7	3	4	2	4	1	6	4	0	0	1						
	Technique 3	2	3	0	1	3	2	0	6	0	5	3	3	3	3	5	3	5	3	0	3						
	Technique 4	0	2	1	1	3	5	4	6	6	3	2	0	2	4	1	6	2	2	0	3						
	Technique 5	1	0	0	0	0	2	2	3	2	2	2	3	2	7	2	1	8	5	2	9						
	Technique 6	1	1	0	2	1	6	4	3	4	3	3	2	2	6	1	8	5	0	1	1						
Total		9	14	2	16	11	24	17	23	17	22	15	13	14	26	11	25	27	10	3	19						
DT 9 Self-monitor	Technique 1	0	0	0	0	5	8	2	8	4	3	5	4	2	4	0	2	2	1	1	2						
	Technique 2	5	7	2	5	3	5	4	5	2	4	2	1	2	0	0	4	1	0	0	1						
	Technique 3	5	7	0	3	1	5	3	5	2	4	3	8	2	0	1	0	3	0	1	0						
Total		10	14	2	8	9	18	9	18	8	11	10	13	6	4	1	6	6	1	2	3						
Overall Total		147	172	50	137	125	248	133	201	125	163	101	160	96	141	78	146	155	76	38	154						

Figure 3. Frequency of PD techniques usage across industries (Source: Authors' own elaboration)

Table 8. Percentage of participants using the design principle #1: Tunneling

Methods	Top-2	Bottom-2
TOC, structural map of course	87	9
Virtual tour of course	34	45
Providing help through buttons or chatbots	36	45

Table 9. Percentage of participants using the design principle #2: Reduction

Methods	Top-2	Bottom-2
Multiple learning paths based on learner goals	43	26

Table 10. Percentage of participants using the design principle #3: Building credibility

Methods	Top-2	Bottom-2
High quality multimedia	85	0
Links for references	72	8

Table 11. Percentage of participants using the design principle #4: Social learning

Methods	Top-2	Bottom-2
Discussion forum, chat rooms	40	32
Leaderboard display	9	74

Table 12. Percentage of participants using the design principle #5: Intervening learners

Methods	Top-2	Bottom-2
Directing learners to contents based on their needs	28	36
JIT course recommendation	32	40
Visual cues to draw attention	94	2

Persuasive design techniques and their usage among participants

The data was further analyzed to calculate the **top-2** and **bottom-2** box scores for each PD technique. These scores summarize the usage of a particular PD technique by IDs across industries. **Table 8** shows the percentage of participants using the design principle #1: tunneling.

The survey uses a 5-point Likert scale–always, frequently, occasionally, rarely, and never. The responses always and frequently were grouped together as a positive response denoting the usage of a particular PD technique while the responses rarely and never are grouped to indicate a negative response. The option occasionally was considered to be a neutral response and is not used in our analysis below. The **top-2** column indicates the percentage of IDs using a PD technique and the **bottom-2** column indicates the percentage of IDs not using a PD technique. The survey questions are categorized according to the PD principles they are based upon.

The first set of questions references the PD principle of tunneling that focuses on guiding learners throughout the course. About 87% of the participants agree to always or frequently use the following PD techniques: table of contents, structural map, or flowchart to show the organization of modules or multiple levels in a course. On the other hand, only around 34% of participants employ the techniques of providing guidance through chatbots, the “help” button, or showing participants a virtual tour of the course interface.

The second set of questions is based on the PD principle of reduction, which aims to reduce the complexity of the learning tasks. 43% of participants use multiple learning paths to learners based on their individual goals (**Table 9**).

The third set of questions is based on the PD principle of credibility that covers techniques for building credibility into course designs. Techniques to implement this principle: trustworthy, expertise, surface credibility, and real-world feel were all included under this topic. The two techniques, providing high-quality multimedia content and including reference links for learning content, are widely used by participants (**Table 10**).

The fourth set of questions references the PD principle of social learning. Several techniques to implement social learning such as discussion forums, and leaderboards are addressed under this topic. 40% of the survey participants use collaborative instructional techniques such as discussion forums, and chat rooms in their designs. It is also interesting to note that about 74% of participants do not include social comparison techniques, such as leaderboards to encourage learners (**Table 11**).

The fifth set of questions references the PD principle of suggestion that focuses on intervening learners at the right opportune moment. An overwhelming 94% of the participants (50 in count) include visual cues to draw learners’ attention to the critical part of the lesson contents. Redirecting course contents based on learners’ test scores is rarely sought after as an influencing design technique (**Table 12**).

The sixth set of questions is based on the PD principle of reinforcement. Positive reinforcement can be provided to learners through awards, praise, and recognition. Almost 60% of the survey participants stated that they rarely or never use these reinforcement techniques such as awards or badges to influence learning (**Table 13**).

Table 13. Percentage of participants using the design principle #6: Reinforcing learners

Methods	Top-2	Bottom-2
Awards, badges, stickers	8	58

Table 14. Percentage of participants using the design principle #7: Personalization techniques

Methods	Top-2	Bottom-2
Interactive scenario-based/context-based contents	70	6
Using examples and non-examples	89	2
Animations	62	8
AR or VR technologies	8	79
Accessibility options–videos, text, or video with captions	51	23
Synchronous or asynchronous tools for communication	53	38

Table 15. Percentage of participants using the design principle #8: Emotional affordability

Methods	Top-2	Bottom-2
Options for anonymous feedback	64	25
Fun ways of gathering feedback–icons, images	32	34
Options for learners to express their current emotional state using characters, avatars, etc.	42	38
AR or VR technologies	15	68
Content delivered through human-like character	42	36

Table 16. Percentage of participants using the design principle #9: Self-monitoring techniques

Methods	Top-2	Bottom-2
Interactive techniques for content reflection	43	26
Tools for time management	32	47
Analytics on tests	68	15
Progress bar/level of completion	55	13

The seventh set of questions references the PD principle of tailoring. The tailoring techniques used frequently by IDs are presenting content using interactive scenarios, using examples and non-examples to explain content, and including animations to design content. Almost 80% (about 42 in count) of the participants do not currently use AR or VR technologies in their courses (**Table 14**).

The eighth set of questions is based on providing emotional affordability. Out of the five techniques listed to the participants, allowing learners to provide anonymous feedback is most used by about 64% of the participants (**Table 15**).

The last set of persuasive techniques is based on the principle of monitoring one's progress. Including progress bars, notifying the level of completion, and providing analytics on tests are the techniques that are widely being applied by learning designers across industries to engage and motivate learners. About 68% of participants (36 in count) use tests, knowledge check scores, and further analytics to inform learners about their progress in learning (**Table 16**).

The results from the nine questions provide insights into how the industry has moved forward in terms of engaging and motivating learners. Displaying leaderboards to motivate learners and awarding them with badges and stickers to reinforce learning is least preferred by more than 73% (about 39 in count) of learning designers across multiple industries.

In addition, although current technologies such as AR and VR have the potential for personalizing learning and making it more engaging and contextual, almost 80% (42 in count) of the survey participants do not use them currently in their designs.

Qualitative Analysis

The purpose of the two open-ended questions in the survey is to investigate the reasoning behind participants' responses to questions 1 to 9. Only 31 records out of the 53 samples had completed responses to the open-ended questions. Therefore, analysis was conducted on the 31 participant answers to uncover patterns of emerging themes. In the first open-ended question, participants were asked about their day-to-day challenges limiting the application of PD techniques. We identified six themes from the participants' responses to this question. The second open-ended question was designed to acquire participants' recommendations for new PD techniques they find effective in their training. After analyzing and categorizing the responses, four themes emerged. In the section below, we'll discuss our analysis of the two open-ended questions and their results.

Question #1: Challenges limiting the application of PD techniques

Every participant's response was read carefully to identify themes. Responses falling into related categories were grouped together resulting in the following themes: expertise, infrastructural restrictions, client needs, project needs, culture in the organization, and nature of the content.

These themes were further examined to identify any recurring patterns. For example, the theme expertise and infrastructural restrictions both indicated the limitations faced by IDs in their technical work environment as reasons for not applying some of the design techniques in their work resulting in a pattern. Hence these two themes were merged into an overarching concept "technical restrictions". In the same way, our analysis resulted in uncovering three additional concepts: nature of the project, organizational culture, and nature of the content.

Table 17. Responses, frequency of occurrence, theme, and overarching concept for open-ended Q1

Participant responses	FO	Themes	Overarching concept
ROI, Not an expert, No expertise	3	Expertise	Technical restrictions
Technical restrictions, Restricted by software, Availability, LMS does not accommodate, No monetary sources, Not much flexibility, Infrastructure, Technology limitations	7	Infrastructural restrictions	
Client needs, Client specifications, The client did not request	3	Client needs	Nature of project
Due date, topic, and delivery, Method present challenges, Not enough time, Budget, Monetary	5	Project needs	
Culture, Institution needs, Leaderboards and extensive use of visual cues are ableist, Corporate decision, Clients are orthodox	6	Organizational culture	Organizational culture
A reasonable, dignified, and kind voice, Not applicable, Some of the things do not go well, Nonrelevant, Software systems training, Course specifics, Value add	6	Nature of content	Nature of content

Note. FO: Frequency of occurrence

Table 17 details the development of initial themes from the participant responses and the overarching concept.

Our analysis discovered technical restrictions, nature of the project, organizational culture, and nature of content as the four main challenges experienced by IDs in their work restricting them from using certain PD techniques. Furthermore, participants' answers indicate that overcoming limitations and applying the PD techniques in the learning programs could positively influence learners.

Technical restriction: The availability of an authoring tool plays a big role in deciding the implementation of certain PD techniques. For example, higher-Ed IDs expressed how the limitations of an LMS system affect course design. If an organization's LMS systems do not provide options to gamify a course or include a "help" button, then eventually those features cannot be added to a course. Some of the participant responses: "I do not have proper tools in my LMS", "when I stated rarely or never, it is likely due to technical restrictions" informs us of the restriction imposed by technical factors. In a corporate industry, a technical limitation, for example, an absence of AR or VR technologies, could constrain the development of a more personalized course. Some companies using AR/VR technologies skill train their employees in a virtual environment that provides a safe platform for participants to make mistakes and learn from their errors. In addition to the infrastructural limitations, technical skills and knowledge of an ID also present a challenge when adopting certain PD techniques. Sometimes, IDs are required to use a tool in a project on which they have no prior knowledge or experience. In such situations, not having enough time to explore the tool due to project deadlines or not having opportunities at an organizational level for professional development, or ID's reluctance to challenge themselves to think of creative solutions can come in as a challenge.

Nature of project

More than 10 people from the corporate industry have mentioned project characteristics as a challenge. Course designs are to a greater extent decided by the budget and timelines allocated by clients. Application of certain design techniques can be considered as "frills" and unnecessary with the allotted budget and time. In addition to the budget and time restrictions, clients' desires also play a significant role in determining a course design. These are more evident from the following participant responses such as: "I have many client organizations who do not want frilly or fun things thinking it's not serious learning", and "depends on client specifications".

Organizational culture

The culture of an organization has come out to be another determinant for IDs to incorporate the latest designs and techniques in their work. All higher-Ed institutions are built to serve a diverse student population and are looking for ways to make learning accessible for all their students. Hence, the PD technique of social comparison is unwelcomed in academia as it can be partial towards a certain set of students. One of the participants explained this through their statement, "leaderboards and extensive use of visual cues are ableist". On the other hand, the openness of an organization to accept new creative ideas and their willingness to let their employees explore also plays a critical role for IDs to implement innovative designs in projects.

Nature of course contents: The course topic and its contents predominantly decide most of the design elements. For example, topics such as domestic partner violence cannot be expressed through humorous characters or language and reinforced through games. Similarly, a course demonstrating a software product can be best instructed using simulations. One of our participants' makes this clear through their response, "a lot of my work is software systems training with simulations- industry-specific databases and applications so not all techniques are applicable or appropriate".

Question #2: Recommendation from IDs on new PD techniques

The second open-ended question asked for recommendations from participants on new PD techniques to produce engaging and influencing courses. Participant responses were analyzed to identify themes that were further grouped together to form overarching concepts as shown in **Figure 4**.

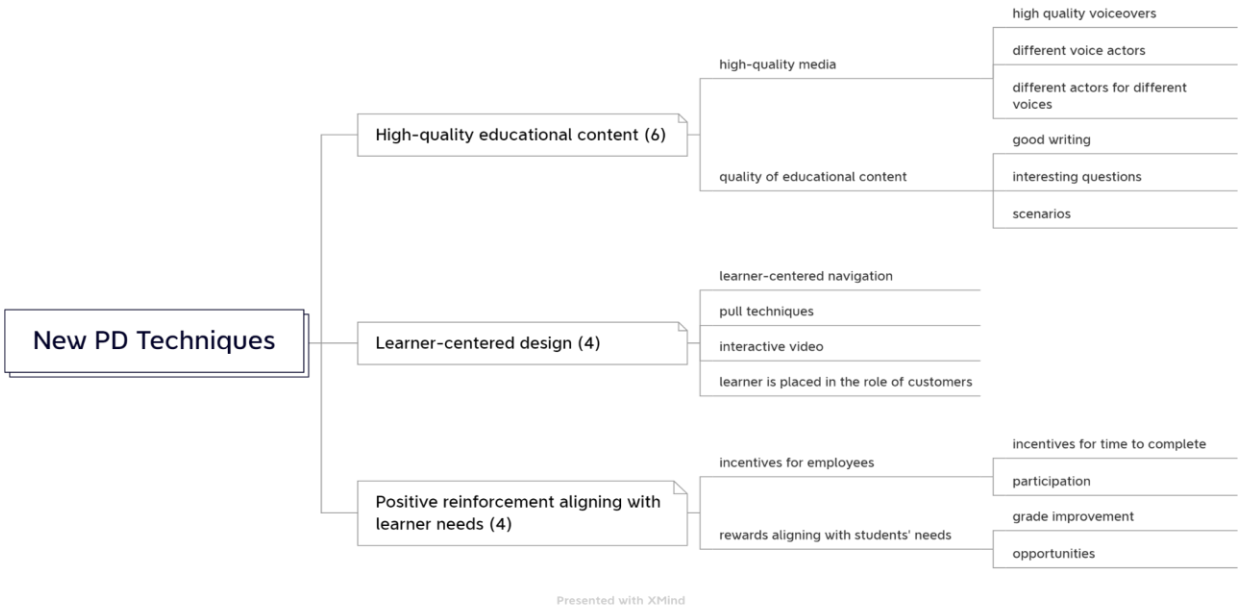

Figure 4. Participant responses, frequency of occurrence, themes, and overarching concepts for open-ended Q #2 (Source: Authors' own elaboration)

High-quality educational content

This design element was specially recommended for courses in a higher-Ed setup where technological limitations can inhibit the implementation of many design techniques. Providing high-quality content with good writing and voice-overs can provide credibility to the content thereby motivating learners to engage better with a course.

Providing high-quality educational content falls under the second dimension of the WBL model, "credibility support". The seven PD techniques mentioned under this category are informativeness, trustworthiness, surface credibility, real-world feel, expertise, verifiability, and third-party endorsements. Participants' suggestions of providing high-quality content and voice-overs are techniques of applying PD techniques Informativeness and surface credibility.

Learner-centered design

The term learner-centered design can comprise a wide range of PD techniques under its envelope. Some of the specific ideas discussed in the participant responses are, as follows.

Immersive learning: Bringing the three modalities–thinking, feeling, and experience, into action, is important for an enriching learning experience. Courses built without including any of these three elements can affect learning quality. For example, a course in customer service can make learners play the role of customers using scenarios or blended classroom learning techniques. By doing so, learners come to understand the perspective of customers and learn to empathize with them while responding to their service requests.

Learner selected navigation: By designing a lesson using more than one format (video-based, scenario-based, text-based) and through open-ended interactions, learners can be provided an option of choosing a format based on their preferences.

Pull not push: Instead of providing learners with all the contents, interactive questions can be utilized to cultivate learners' interest in the topic. Learners can then be given access to appropriate lessons based on their needs.

The first two participant suggestions–immersive learning and learner selected navigation are different techniques of implementing the PD principle, tailoring. In the third suggestion, "pull not push", learners are initially taken through a set of questions to ignite their interest and to help them gauge their level of understanding. This technique of taking learners through a predetermined set of activities and persuading them along the way is a method of implementing the PD technique, tunneling. The two techniques, tunneling, and tailoring are categorized under the dimension "primary task support".

Positive reinforcement aligning with learners' needs

Providing positive reinforcement in terms of incentives can encourage learner participation. For example, in a corporate environment, learners can be incentivized with a gift card, or publicly appreciated in their group meeting for completing a training course in a shorter duration. In a higher-Ed institution, learners can be incentivized with grade improvement options for participating in a class or taking a course before a certain deadline.

This method of incentivizing learners falls under the "learner support" dimension of the WBL model. The learner support dimension supports ten PD techniques: style, suggestion, praise, reward, recognition, liking, competition, social learning, social comparison, and social facilitation. Participants' suggestion to incentivize learners is one of the ways of implementing the PD techniques–praise, reward, and recognition.

Table 18. Frequently used PD techniques

Methods	Percentage usage
Providing guidance: TOC, structural map of course	87
Credibility in design: High quality multimedia	85
Intervening techniques: Visual cues to draw attention	94
Personalization: Using examples and non-examples	70
Interactive context-based materials 89 6 personalization	89
Animations	62
Emotional affordability: Options for anonymous feedback	64
Self-monitoring: Analytics on tests	68

Table 19. Frequently used PD techniques

Methods	Percentage usage
Social learning: Leaderboard display	74
Reinforce learners: Awards, badges, stickers	58
Personalization: AR or VR technologies	79
Emotional affordability: Options for learners to express their current emotional state	68

RESULTS

The purpose of this study is to identify the persuasive techniques that are available for designing online learning content and to learn from IDs the techniques they frequently use in their work. Also, the study is designed to uncover from IDs, the challenges inhibiting them from applying some of the PD techniques, their implications, and their recommendations for new PD techniques.

Usage of Persuasive Design Techniques Among IDs

Among the 26 design techniques discussed in the nine questions, eight are predominantly used by IDs in their course designs (**Table 18**).

There are four PD techniques among the 26, which were reported to have been rarely or never used by IDs (**Table 19**).

Industry and Design Choices

Our analysis of participant responses brought insightful discoveries about the effect of the IDs industry on their design choices. For example, while the method of collaborative learning through discussion forums and chat rooms is quite frequently or always used in higher-Ed settings, our participant responses show that they are less preferred as an influencing design method in a corporate environment. Similarly, in contrast to higher-Ed, learning designers in corporate seem to rarely provide options for learners to communicate with their instructors. This leads us to postulate that most corporate training programs must be highly interactive when compared to the higher-Ed programs to accommodate for the unavailability of instructor interactions. If not already, corporates should highly consider developing interactive training for their employees with adequate scaffolding techniques so that their employees can make the best use of the training programs. The interactiveness and support provided for employees in corporate training is a critical topic for further research.

Social comparison techniques were considered motivators for learning. One of the leading techniques of applying social comparison design is leaderboard display. In contrast to this consideration, IDs in both higher-Ed and corporate industries discourage the use of leaderboards as an influencing design method. IDs are moving toward making learning accessible for diverse learners and usage of leaderboards in courses is considered as a prejudice favoring able-bodied learners.

Other useful PD techniques

Participants through their open-ended answers provided their recommendations for PD techniques they find useful in their learning designs. All these recommendations fall under WBL's three main categories of primary task support, building credibility, and learning support. The first recommendation is to provide positive reinforcement to learners in terms of incentives that are aligned with learner goals. The second recommendation is for high-quality online learning content with good writing and voice-overs. Finally, IDs emphasize designed content keeping learners in mind (i.e.) providing opportunities for immersive learning and learner-centered navigation.

LIMITATIONS AND FUTURE RESEARCH

Our analysis is based on the survey questions presented to the participants and these questions are based on the WBL model. Instructional design is a creative process and there can be multiple ways of implementing a persuasive principle. While the survey questions covered more than one popular way of implementing every PD principle, it is probable that they do not represent every possible way of applying specific PD principles. Most of our survey participants were from the academia and corporate sectors, and we do not know for sure if their work included developing training for diverse industries. For example, in industries such as energy, and aviation, including retail, companies employ the latest technologies to train their field personnel in a virtual training environment that cannot be delivered in real-time.

Based on the learnings from this study, we recognize multiple opportunities for further research and here are our two proposals. The first proposal is to find out effective techniques that can persuade participants to make the right choice from a list of available choices. For example, how can we persuade employees to upload their daily work into their company's SharePoint system even when there are no consequences for doing otherwise. The second proposal is to discover conducive environments for implementing PD techniques and identify the actions organizations can take to nurture those environments.

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Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

Arendt, C., Myers, T., & Trevathan, J. (2014). Simulating house cooling methods to decrease energy consumption by creating awareness and attitude change. *International Journal of Smart Home, 8*(2), 177-190. https://doi.org/10.14257/ijsh.2014.8.2.18

Barari, N., RezaeiZadeh, M., Khorasani, A., & Alami, F. (2020). Designing and validating educational standards for e-teaching in virtual learning environments (VLEs), based on revised Bloom's taxonomy. *Interactive Learning Environments, 30*(9), 1640-1652. https://doi.org/10.1080/10494820.2020.1739078

Behringer, R., & Sinclair, G. (2013). *Proceedings of the International Workshop on EuroPLOT Persuasive Technology for Learning, Education and Teaching (IWEPLET 2013)*. UNSPECIFIED.

Bouchrika, I., Harrati, N., Wanick, V., & Wills, G. (2019). Exploring the impact of gamification on student engagement and involvement with e-learning systems. *Interactive Learning Environments, 29*(8), 1244-1257. https://doi.org/10.1080/10494820.2019.1623267

Daud, N. A., Ashaari, N. S., & Muda, Z. (2015). Initial validation of persuasive model for web-based learning. *Journal of Theoretical and Applied Information Technology, 81*(2). 355-363.

Devincenzi, S., Kwecko, V., de Tolêdo, F. P., Mota, F. P., & Casarin, J., & da Costa Botelho, S. (2017). Persuasive technology: Applications in education. In *Proceedings of the 2017 IEEE Frontiers in Education Conference* (pp. 1-7). IEEE. https://doi.org/10.1109/FIE.2017.8190439

Fogg, B. J. (2009). A behavior model for persuasive design. In *Proceedings of the 4th International Conference on Persuasive Technology* (pp. 1-7). ACM. https://doi.org/10.1145/1541948.1541999

Goh, T.-T., Seet, B.-C., & Chen, N.-S. (2012). The impact of persuasive SMS on students' self-regulated learning. *British Journal of Educational Technology, 43*(4), 624-640. https://doi.org/10.1111/j.1467-8535.2011.01236.x

Halttu, K., & Oinas-Kukkonen, H. (2017). Persuading to reflect: Role of reflection and insight in persuasive systems design for physical health. *Human-Computer Interaction, 32*(5-6), 381-412. https://doi.org/10.1080/07370024.2017.1283227

Halttu, K., & Oinas-Kukkonen, H. (2021b). Susceptibility to social influence strategies and persuasive system design: Exploring the relationship. *Behaviour & Information Technology, 41*(12), 2705-2726. https://doi.org/10.1080/0144929X.2021.1945685

Kasali, F., Afolashade, K., & Oludele, A. (2020). Systematic review of persuasive health technology design and evaluation models. *International Journal of Computer Science and Business Informatics, 17*(1), 12-27.

Mintz, J., & Aagaard, M. (2012). The application of persuasive technology to educational settings. *Educational Technology Research and Development, 60*(3), 483-499. https://doi.org/10.1007/s11423-012-9232-y

Oduor, M., & Oinas-Kukkonen, H. (2019). Committing to change: A persuasive systems design analysis of user commitments for a behaviour change support system. *Behaviour & Information Technology, 40*(1), 20-38. https://doi.org/10.1080/0144929X.2019.1598495

Park, T., & Lim, C. (2019). Design principles for improving emotional affordances in an online learning environment. *Asia Pacific Education Review, 20*(1), 53-67. https://doi.org/10.1007/s12564-018-9560-7

Petersen, J. E., Frantz, C., & Shammin, R. (2014). Using sociotechnical feedback to engage, educate, motivate, and empower environmental thought and action. *Solutions, 5*(1), 79-87.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology, 19*, 123-205. https://doi.org/10.1016/S0065-2601(08)60214-2

Roloff, M.E., & Miller, G.R. (1980). *Persuasion: New directions in theory and research*. SAGE.

Zhang-Kennedy, L., Chiasson, S., & Biddle, R. (2016). The role of instructional design in persuasion: A comics approach for improving cybersecurity. *International Journal of Human-Computer Interaction, 32*, 215-257. https://doi.org/10.1080/10447318.2016.1136177

APPENDIX A

Survey Questions

For each of the following survey questions, respondents were asked to choose their responses from the Likert scale with five ranking options (5=always, frequently, occasionally, rarely, never=1).

Table A1. Survey questions

1. Guide learners through your course contents.	1. Provide table of contents, structural map, or flowchart to show the organization of modules or levels in a course.
	2. Provide a virtual tour of a course interface (through mouse-over-screen action or short videos).
	3. Include "help" button or chatbots to address any technical difficulties.
2. Reducing complexity in your designs.	4. Provide multiple learning paths based on learners' goals.
3. Building credibility into your designs.	5. Include high quality multimedia.
	6. Provide reference links for all learning contents.
4. Bringing social learning into your designs.	7. Include options for collaboration–discussion forum, chat rooms.
	8. Motivates learners with a leaderboard display.
5. Intervening techniques in your designs.	9. Guide learners to appropriate course contents based on their performance in tests.
	10. Generate a just-in-time recommendation of courses relevant to learners' level or role.
	11. Using visual cues to draw attention to critical lesson contents (highlight, color, boldness).
6. Using the reinforcement techniques.	12. Award badges, stickers or avatars based on learner's performance level.
7. Following personalization strategies in your design.	13. Present interactive scenario-based or context-based learning material.
	14. Use examples and non-examples to explain contents.
	15. Design content using animations.
	16. Use Augmented Reality or Virtual Reality technologies in designing content
	17. Include options for learners to choose from either videos, text, or video with captions.
	18. Include options to select synchronous or asynchronous tools to communicate with instructors.
8. Providing opportunities for learners to express their emotions.	19. Allow learners to express their opinion on the course or instructor as an anonymous person.
	20. Design content using humor (comics, cartoons).
	21. Make feedback fun using icons, images, or sounds.
	22. Allow learners to express their current emotional state through avatars, photos, characters, etc.
	23. Convey content through human-like characters with facial expression and gestures.
9. Including self-monitoring techniques for learners.	24. Provide opportunities to reflect on course contents using interactive techniques like games.
	25. Provide analytics on tests or knowledge checks (quiz scores, time taken to complete).
	26. Provide tools for time management–to extend deadlines or to keep track of start & end dates.
	27. Include progress bar and level of completion notification.

10. If you had answered rarely or never for any of the questions above, please provide your reasons.
11. In addition to the listed techniques above, do you recommend any other persuasive technique(s) to engage your learners? If so, please list them for us.
12. How long have you been working in the instructional design field?
    - 3+ years
    - 4 - 8+ years
    - 9 -14 years
    - 14+ years
13. Which industry do you currently work in?
    - Higher ED
    - K-12
    - Corporate
    - Non-profit
    - Others–please specify