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Review of Persuasive Technology Strategies in M-Learning Applications

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ABSTRACT: The objective of this research is to uncover the hidden persuasive strategies used in mobile learning (m-learning) applications and relate them to the success of the product in the market. The research aims (i) to examine the amount of persuasion used in m-learning apps, (ii) to identify the persuasion principles that are used the most among the analysed applications, and (iii) to uncover the consequences of m-learning apps using persuasive strategies strategically. This study employs the method of the qualitative systematic review. Accordingly, 10 mobile learning applications were compared and systematically analysed. The applications are reviewed based on the principles of the Persuasive Systems Design Model (PSD Model).

KEYWORDS: Persuasive Technology, M-learning, PSD Model, Mobile Applications

I. INTRODUCTION

Persuasive technology (PT) is the hidden backbone towards the success of all the top mobile applications in the market today. Starting from the color theme of the applications to the kind of notification messages that are being sent, all the popular apps such as Instagram, Facebook, YouTube, etc., embody persuasive principles strategically to get users addicted to them.

The term "Captology" which is an abbreviation for "Computers As Persuasive TechnOLOGY" was coined by scientist BJ Fogg. Fogg defines persuasive technology as interactive information technology created to alter the users' behavior or attitudes without the usage of deception or coercion [1]. PTs can be considered ethical for as long as there is no deception involved and it is in the best interest of the user attaining their goal. Implicit persuasions are something we users tend to be unaware of but it is worthy to note these to be mindful of the usage of the applications. Such ability for a piece of technology to have a strong and lasting persuasive effect on the user has it to have widespread usage in various domains like commerce, education, safety, productivity, healthcare, and personal management [2].

II. RELATED WORK

The benefit of the usage of PT in educational applications has been tried and tested to be beneficial on various projects. The most popular one being the HANDS project which was a mobile application that used persuasive principles for positive behavior change in young people with Autistic Spectrum Disorders [3]. The EuroPLOT project also proved that PTs can enhance the learning capabilities of the user [4]. Furthermore, m-OVADor, a Virtual Learning Object (VLO) based on persuasive technology was seen to be an effective technique for teaching nursing students about acute pain assessment in a different study [5]. Another study proved the Capabilities of Web 2.0 to improve the learning behavior of students [6].

In recent years, however, there is a surge in the number of Mobile Learning (M-learning) applications in the market. Mobile Learning can be defined as the usage of personal electronic devices for learning over multiple contexts, through social and content interactions [7]. Personal electronic devices that are predominantly used are mobile phones, tablets,



and laptops. However, in this study, the focus will be on applications that are designed for mobile phones and tablets. The most widely used applications in this context are Udemy, Duolingo, Coursera, EdX, Khan Academy, SoloLearn, Skillshare, LinkedIn Learning, Primer, and Grasshopper.

The biggest advantage of these applications is their mobility as they are accessible from any location at any time for as long as there is network connectivity. On the other hand, these applications also meet with a multitude of challenges like the absence of universal access, restricted screen resolution and size, cost, technical difficulties, the possibility of distractions, and the danger of sudden disuse [8]. The former four are inevitable by nature of the mobile device design and the extent of technological advancement in the present day.

Concerning the latter of the challenges, it is undoubted that m-learners can quickly get distracted or bored in the course of learning through the app. This is why the experience of using the application must be engaging and well-suited. Hence, distraction and discontinuance may be able to be mitigated by employing strategic application design and the use of persuasive technology principles.

III. CRITERIA TO EVALUATE PERSUASION IN INTERFACES

3.1 Fogg’s Functional Triads

The functional triad is a framework built by BJ Fogg. It depicts the three different roles that computing technologies can portray [1]. The roles are tools, media, and social actors.

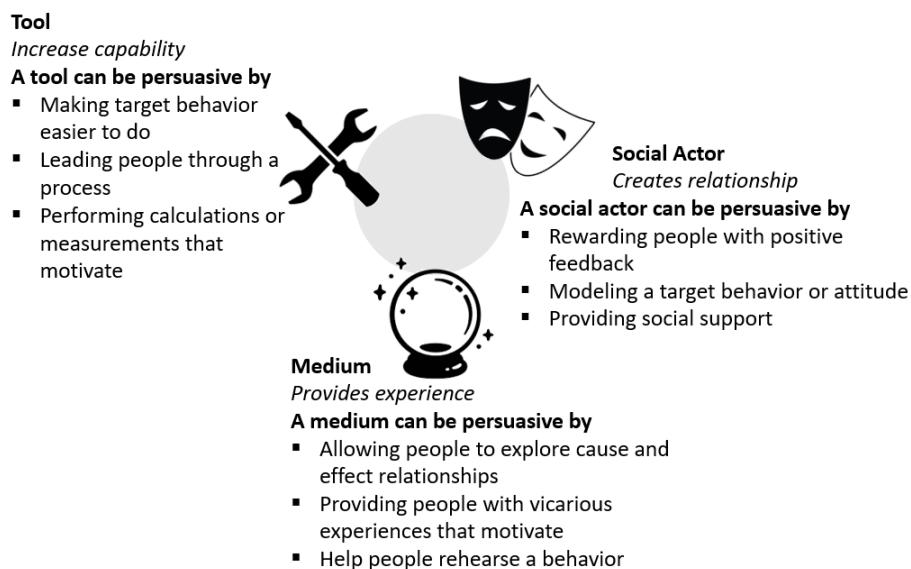


Fig 1. Functional roles of persuasion of Computing Technologies[1]

- **TOOL - Persuasive Technology Tools:** Interactive products that make the desired outcomes of the user easier to achieve. The strategies are Reduction, Tunnelling, Tailoring, Suggestion, Self-Monitoring, Surveillance, and Conditioning.
- **MEDIUM - Persuasive Technology Mediums (Simulation):** Computing technology that uses simulated experiences to mold the behavior and attitude of the user. The strategies are Cause and Effect, Virtual Rehearsal, Virtual Rewards, and Simulation in Real-World Context.



- **SOCIAL ACTOR - Persuasive Technology Social Cues:** Products that give out social cues to evoke social responses from the user and thereby persuade them. The strategies are Attractiveness, Similarity, Praise, Reciprocity, and Authority.

3.2. The PSD Model

The Persuasive Systems Design (PSD) model is a framework built by Oinas-Kukkonen and Harjuma for modeling and assessing persuasive systems [9]. It comprises twenty-eight persuasive design guidelines built based on Fogg's Functional Triads. Oinas-Kukkonen & Harjuma categorize the twenty-eight principles into four categories. They are Primary Task Support, Dialog Support, System Credibility Support, and Social Support.

3.2.1. Primary Task Support: The principles under this category help the user to carry out the primary task intended. The principles are as follows.

1. Reduction: Reduce the effort that has to be taken to perform the target behaviour by molding the complex behavior into simple tasks.
2. Tunneling: Step-by-step guidance along the process of attaining the goal.
3. Tailoring: Customize the displayed content according to the user's interests, personality, needs, or the context of usage[10].
4. Personalization: Offer content and services best suited to the user.
5. Self-Monitoring: Keep track of the performance and status of the user.
6. Simulation: Provide simulation for users to observe the cause (behavior) and effect (outcome) relationship.
7. Rehearsal: Allow the user to rehearse their target behavior.

3.2.2. Dialogue Support: The principles to implement dialogue between the computer and the human users in order to give feedback to them. The principles are as follows.

1. Praise: Provide positive comments in the form of text, images, symbols, or audio to reinforce behavior[10].
2. Rewards: Provide virtual rewards on the performance of target behavior.
3. Reminders: Remind users of their target behavior at appropriate times.
4. Suggestion: Offer fitting suggestions of steps to achieve the desired outcome.
5. Similarity: Use features that the users are already well familiar with.
6. Liking: Have an appealing look and feel.
7. Social Role: Addition of a social role to be played by the system.

3.2.3. System Credibility Support: The principles to design a system that is credible to the user and hence persuasive.

1. Trustworthiness: Provide information that is unbiased and accurate.
2. Expertise: Provide a knowledgeable, experienced and competent source of information.
3. Surface Credibility: The system should have an efficient appearance and feel, to make a good first impression with the user.
4. Real-World Feel: Features the organization and the people behind the system's services and content.
5. Authority: Make references to people in authoritative positions.
6. Third-Party Endorsement: Provide endorsements from well-known and respected sources.
7. Verifiability: Allow the information to be cross-verified by citing the sources.

3.2.4. Social Support: The principles to motivate the user by leveraging social influences.

1. Social Learning: Enable users to observe their peers carry out the target behavior, and thereafter the outcome of their behavior.
2. Social Comparison: Allow the users to compare their performance with that of their peers.



3. Normative Influence: Create a way to gather the people who have the same goals and make use of social pressure to bring about the target behavior.
4. Social Facilitation: Allow the users to determine the other users who are parallely performing the target behavior.
5. Cooperation: Make use of the nature of people to cooperate with the system.
6. Competition: Make use of the tendency of the users to compete with the other users of the system.
7. Recognition: Give public recognition to the users upon any achievement or the performance of the target behavior.

IV. METHODOLOGY

The review process started with the selection of the m-learning applications that were to be analyzed. The top ten most popular applications worldwide were chosen from Google Playstore. They are Skillshare, LinkedIn Learning, Primer, Grasshopper, edX, Coursera, Khan Academy, SoloLearn, Duolingo, and Udemy.

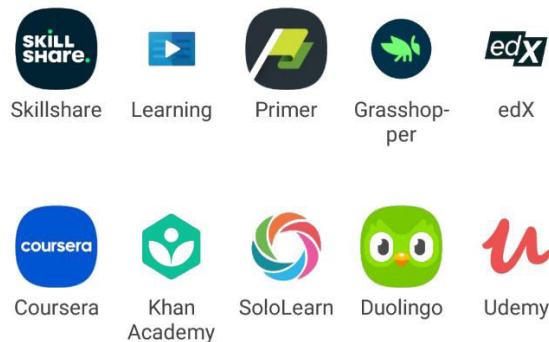


Fig 2. The mobile icons of the list of m-learning apps used in the study

The PSD Model and the principles that lie within were used to analyze the persuasiveness of the applications by performing a detailed qualitative study of the applications by interviewing the daily users of the apps and also by directly using and analyzing the apps.

The following statements were analyzed for each parameter pertaining to the m-learning app.



CATEGORY	PERSUASIVE STRATEGY	STATEMENT
TASK SUPPORT	<i>REDUCTION</i>	The mobile app makes it easier for me to complete the course and learn the skill.
	<i>TUNNELING</i>	I get step-by-step guidance from the app along the way while taking up the course.
	<i>TAILORING</i>	I can customize the app content according to my needs and interests.
	<i>PERSONALIZATION</i>	The app personalizes the content and the service according to each of its users.
	<i>SELF-MONITORING</i>	My progress in the course and my performance are kept track of by the app.
	<i>SIMULATION</i>	The app shows evidence of a good outcome in other people who have regular learning behavior and have completed the course
	<i>REHEARSAL</i>	The app has practical components in it so that I can use what I learned in a life-like scenario.
DIALOG SUPPORT	<i>PRAISE</i>	The app sends positive feedback or praises you in words, images, symbols, or sound whenever you perform well in the course and the quizzes.
	<i>REWARDS</i>	The app provides virtual rewards (scores and badges) for reaching learning goals.
	<i>REMINDERS</i>	The app sends reminders (emails or notifications) for you to get learning regularly.
	<i>SUGGESTIONS</i>	The app offers fitting suggestions of steps to achieve the desired outcome of learning the skill and completing the course.
	<i>SIMILARITY</i>	The app did not seem completely unusual on the first use. It has features that the users are already well familiar with.
	<i>LIKING</i>	The app has an attractive look and feel.
	<i>SOCIAL ROLE</i>	The app has a chatbot or a virtual assistant or any virtual character in it/The app supports communication between the users of the app.
SYSTEM CREDIBILITY	<i>TRUSTWORTHINESS</i>	The app provides information that is truthful, fair, and unbiased.
	<i>EXPERTISE</i>	The app provides a knowledgeable, experienced, and competent source of information.
	<i>SURFACE CREDIBILITY</i>	The app has a competent look and feel, and made a good first impression.
	<i>REAL-WORLD FEEL</i>	The app highlights the people and the organization behind its content or services.
	<i>AUTHORITY</i>	The app makes references to people in the role of authority.
	<i>THIRD-PARTY ENDORSEMENT</i>	The app is endorsed/advertised by famous personalities.
	<i>VERIFIABILITY</i>	The app allows the information to be cross-verified by citing the sources.
SOCIAL SUPPORT	<i>SOCIAL LEARNING</i>	The app allows users to know the others are learning the course, their outcomes, and progress.
	<i>SOCIAL COMPARISON</i>	The app provides means for you to compare your performance with that of others who took the course.
	<i>NORMATIVE INFLUENCE</i>	The app makes use of 'peer pressure' with you and the other users to reach your learning goals.
	<i>SOCIAL FACILITATION</i>	The app provides means to determine the other users who took up or are parallelly taking up the same course.
	<i>COOPERATION</i>	The app leverages the natural tendency of human beings to co-operate by making you go along at the pace of others (or your friends) in the course or by implementing deadlines.
	<i>COMPETITION</i>	The app lets you compete with the other learners in terms of performance.
	<i>RECOGNITION</i>	The app provides public recognition to the users who perform well in the course.

Table I.The persuasive principle and a statement of relevance from the learning point of view

It is important to note that the use of persuasive techniques can be extended to instructional design in itself to make the instruction and subject matter much more engaging in the case of recorded lectures. However, due to the varying nature



of courses in the m-Learning applications, the persuasive nature of the application and its design only will be focused upon in this study and not the course materials of the course enrolled in.

V. EXPERIMENTAL RESULTS

The following table was constructed after the analysis of the applications for the principles of the PSD Model.

CATEGORY	PERSUASIVE STRATEGY	UDEMY	DUOLINGO	LEARNING	COURSERA	SOLO LEARN	KHAN ACADEMY	PRIMER	GRASS HOPPER	EDX	SKILLSHARE	SCORE
TASK SUPPORT	REDUCTION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	TUNNELING	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	TAILORING	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	PERSONALIZATION	✓	✓	✓	✓					✓	✓	6
	SELF-MONITORING	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	SIMULATION	✓				✓					✓	3
	REHEARSAL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
DIALOG SUPPORT	PRAISE	✓	✓		✓	✓	✓	✓	✓			7
	REWARDS	✓	✓	✓	✓	✓	✓		✓	✓		8
	REMINDERS	✓	✓	✓	✓			✓	✓	✓	✓	8
	SUGGESTIONS	✓	✓	✓	✓	✓		✓	✓	✓	✓	9
	SIMILARITY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	LIKING	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	SOCIAL ROLE		✓				✓				✓	3
SYSTEM CREDIBILITY	TRUSTWORTHINESS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	EXPERTISE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	SURFACE CREDIBILITY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
	REAL-WORLD FEEL	✓		✓	✓		✓	✓	✓	✓	✓	8
	AUTHORITY											0
	THIRD-PARTY ENDORSEMENT		✓								✓	2
	VERIFIABILITY	✓				✓						2
SOCIAL SUPPORT	SOCIAL LEARNING	✓	✓		✓	✓					✓	5
	SOCIAL COMPARISON		✓			✓						2
	NORMATIVE INFLUENCE		✓			✓					✓	3
	SOCIAL FACILITATION		✓	✓		✓					✓	4
	COOPERATION		✓	✓	✓	✓			✓	✓		6
	COMPETITION		✓			✓					✓	3
	RECOGNITION		✓				✓					2
TOTAL PERSUASIVENESS SCORE OF EACH APP		19	24	17	20	21	13	14	16	16	21	

Table II. The resultant table of the applicability of each principle to each of the applications analyzed



The principles that are used by all the apps are Reduction, Tunneling, Tailoring, Self-Monitoring, Rehearsal, Similarity, Liking, Trustworthiness, Expertise, and Surface Credibility. The presence of parameters like Reduction, Tunneling, Similarity, Liking, and Surface Credibility extensively can be attributed to the basic user experience of the applications. These apps are one of the top ones and are from reputed companies and hence a good UX has been seen as a basic necessity. The rest of the parameters which are Tailoring, Self-Monitoring, Rehearsal, Trustworthiness, and Expertise have been employed due to the very nature of the applications as they are intended for educational purposes.

It is quite interesting to note that the aspect of Social Support has been the least used among all the persuasive strategies. Social Support and the parameters within are the ones that tend to motivate and influence the learners to perform better. The sheer lack of the implication of these can be observed to reduce the popularity of the applications.

The apps that make the highest use of these principles are Duolingo, Sololearn, and SkillShare. It is not surprising to find that these apps are also the most highly rated and most used among the other apps in this study. Duolingo for instance is the most widely used one with over a hundred million users across the globe and is also rated 4.6/5 on Google Play Store. The app makes use of all the Social Support features which also makes the app more populated, motivating, and competitive. Conclusively, the app provides an addictive edge for many learners to stay engaged and learn efficiently.

From the research, it was also evident that most of the users prefer to learn at a solid chunk of time using their laptops rather than consuming bits and pieces of information on the go using mobile apps. This is because of the inevitable factor of distraction that comes on the move. However, if people are drawn to checking social media on the move, why not use the learning apps too? One thing that's common in both these apps is that they provide new information but with the latter, there is no element of surprise and gratification with each use.

VI. CONCLUSION

Intelligent new technology can seamlessly be integrated into our lives, enabling us to effortlessly learn and grow every day. Using persuasive techniques appropriately can lead to the success of the app and increase the effectiveness of the learning process. While almost all the applications have a good user experience, the m-learning app that was found to be implementing the maximum number of persuasive principles from all the aspects of the PSD Model is Duolingo. The success of Duolingo may be attributed to the clever usage of persuasive design techniques. This means that the app has handled the single most drawback of mobile learning which is distractions, by being persuasive and engaging.

The sheer element of surprise and instant gratification is an important driving factor in the increased use of social media among people. These elements can also be implemented within m-learning applications to boost the usage of learning apps on the phone among others. Social media apps go to great extents on being persuasive to get the user addicted to them. Educational apps can also implement such strategies, after all this is for the user's well-being. One can always build upon the concept and develop the applications to be more persuasive and motivating.

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