Technology acceptability, acceptance and adoption - definitions and measurement

Camille Nadal
nadalc@tcd.ie
Trinity College Dublin
Dublin, Ireland

Corina Sas
c.sas@lancaster.ac.uk
Lancaster University
Lancaster, UK

Gavin Doherty
gavin.doherty@tcd.ie
Trinity College Dublin
Dublin, Ireland

ABSTRACT

There is much interest in the development of personal health technologies, but many health technologies involve the capture and use of deeply personal and sensitive data, particularly in the space of mental health. For many years, technology researchers have examined concepts such as acceptability and acceptance, but we argue that these are even more important in the health domain, as the possible intrusiveness of technologies could lead to users refusing to even try a technology. During the design process of technology and in formative and summative evaluation, researchers may wish to explicitly address and measure acceptability and related constructs, as well as at different points in the user experience (before use, on first use, after some period of usage). While a range of definitions have been offered independently, many researchers conflate related terms and may benefit both from a coherent set of definitions, and associated approaches to measurement. In this paper, we describe a systematic review of the usage of acceptance, acceptability, and adoption within the mobile health literature, and present a preliminary analysis of the most recent literature.

INTRODUCTION

Technology acceptance is one of the major challenges faced by the designers of new technologies. This is particularly true in healthcare: although technology is becoming increasingly pervasive, patients are a vulnerable population and their data is considered sensitive. This sensitivity is greater in the case of stigmatized health conditions such as mental health [6, 23]. In addition, the perception of a technology by healthcare providers is likely to affect delivery, especially if it is not considered to be sufficiently acceptable [24]. In the last 10 years, we have seen an increasing number of studies addressing the issue of acceptance of mobile health systems. However, this is not an easy task as the user journey towards technology acceptance is complex and often non-linear. A patient who decides to try an application may not use it in the long run; similarly, we cannot be sure that someone who has stopped using a system will not go back to it later [17]. Different stages punctuate the user journey with technology where they, consciously or not, repeatedly make the decision to keep using the system or to give up on it [22]. Technology developers and researchers must address these issues in the design and evaluation of new healthcare technologies, and across the different stages of the users experience of the system.

BACKGROUND

An evolving terminology and range of definitions for these stages can be found in the literature. According to [9, 16, 20], technology *acceptability* is one's perception of a system before use, while technology *acceptance* is one's perception of the system after use. According to Renaud *et al.* [21] technology *adoption* is a multi-phase process starting with "deciding to adopt (selecting, purchasing or committing to use it) and then achieving persistent use". In Karahanna et al, a distinction is made between "pre-adoption and post-adoption (continued use)" [13]. Thus, both phases of adoption, and sustained engagement [10] are distinctive characteristics. While definitions of these terms are available, it would be interesting to know whether recent studies have adopted a common terminology to refer to the different stages of the user journey with a technology. If consistent definitions are not used, this can result in misunderstanding of what studies actually measure and makes comparison of results difficult. Even within the use of single terms, there may be confusion, and a review conducted by Sekhon *et al.* [24] shows the ambiguity around the concept of technology acceptability in the healthcare literature. Building on this, we present in this paper the preliminary results of a systematic review of how the 3 intertwined concepts of technology *acceptability*, *acceptance* and *adoption* are referred to and measured in mobile health, focusing on literature published in the last 2 years. We hope to gain insight into the different meanings associated with these concepts and see to what degree they match the definitions offered within the literature.

To gain a better understanding of what motivates a person's choice to use a system, a number of studies have explored the factors influencing technology acceptance. The most well-known model articulating those factors is probably the Technology Acceptance Model (TAM) [8]. More recent variations of this model such as TAM2 [25] and UTAU [26] exist along with other models specific to healthcare [7, 11, 12, 14]. However, none of these models differentiate the specific stages of technology acceptance in the user journey, or evoke a possible evolution of the influencing factors over time.

METHOD

Search strategy

We searched the PubMed database for papers that address technology acceptance in the broad sense. Following preliminary searches to assess the relevance of search criteria, a search of the MeSH terms "Patient Acceptance of Health Care" and "mobile applications" resulted in a corpus of 287 articles. We present here a preliminary analysis of the subset of papers published since 2017 (116 papers). The aim was to obtain a broadly representative and recent sample from the digital health literature rather than an exhaustive one.
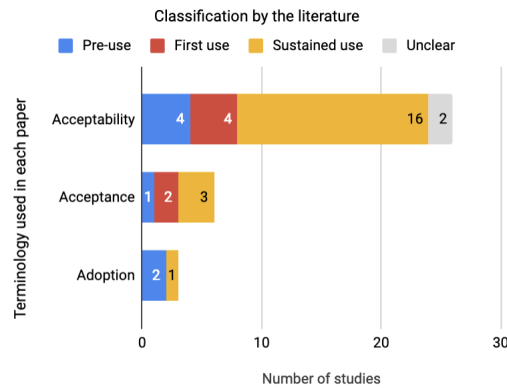
Relevance criteria and coding

We considered as relevant an article that contained at least one of our terms of interest (*acceptability*, *acceptance*, and *adoption*) or the associated verbs (i.e. accept or adopt). In addition, the article had to give a definition for the concept in question, which could be a full definition, a synonym, a comparison, or a cited definition. We excluded papers that did not contain any of the terms or didn't give a definition. Out of the 116 articles, 5 were excluded on the basis of title, 28 on abstract, 51 on full text and 2 for lack of access. This gave us a final corpus of 30 relevant papers.

PRELIMINARY RESULTS

The results of the coding of the 30 relevant articles can be found in Table 1. Our analysis of this corpus reveals that technology acceptance in the broad sense is associated with various meanings and measurements.

Definitions

We observe that, in most cases, the terminology used is not consistent with the definitions given in the literature (see Figure 1). Out of the 24 papers that used the term acceptability (excluding those where interpretation was unclear), the majority (20) measure perception after either initial or sustained usage. This may be that the articles have their own definition of acceptability. Only 4 papers refer to technology acceptability in the sense of users' perception pre-use, sometimes comparing

Table 1: Distribution of main codes (n=30)

Codes	Frequency	(%)
Definition		
Cited reference		
Yes	5	(16.7%)
No	25	(83.3%)
Domain		
Health	6	(20.0%)
Mental health	23	(76.7%)
Both	1	(3.3%)
Goal		
Inform design	5	(16.7%)
Evaluate a system	24	(80.0%)
Review the literature	1	(3.3%)
Define a concept	0	(0.0%)
Measurement		
Standardised survey	11	(31.4%)
Customised survey	15	(42.9%)
Qualitative feedback	3	(8.6%)
Usage	4	(11.4%)
Adherence	0	(0.0%)
Timeline		
Pre-use	6	(17.1%)
Initial use	5	(8.6%)
Post-use	20	(74.3%)
Concept as in literature		

Figure 1: Proportion of acceptability, acceptance and adoption studies. Note: there is some overlap due to a small number of papers using multiple terms.

it to users' interest or willingness to use a system. The rest of the studies understand technology *acceptability* as either user satisfaction, positive feedback received, system usability, user engagement, the actual use of a system or the completion of the study. Some studies also define it as a mix of these concepts. Concerning the articles referring to technology acceptance, 1 (out of 6) interprets it as pre-use (inconsistent with the definition). Finally, 1 paper (out of 3) refer to technology adoption based on longer term use (consistent with the definition); the other two discuss users' perception before use (acceptability). On a higher level, we could think by looking at this corpus that very few studies (3) explore the adoption of a system. However, using the definitions offered within the literature, over half the papers (18) actually explore the longer term usage of a technology, and adoption may be a helpful concept for discussing these studies.

Among the papers that define the terms by reference to the literature, [15] cites the definition of technology adoption given by Agarwal *et al.* [1]. The Fit between Individuals, Task and Technology (FITT) framework [2] is used in [18] as a basis of their study of technology acceptability. However, this framework was intended to measure technology adoption. Finally, Davis' Technology Acceptance Model (TAM) is cited to support a definition in three papers, respectively measuring technology acceptability [27], acceptance [3] and adoption [5]. This shows that the TAM can be interpreted in different ways. The rest of the papers do not refer to any literature models or definitions.

Measurements

The studies of our corpus show a strong preference for the measurement by surveys (Table 2), most often custom surveys (i.e. non standardised) with an average percentage of use of 56% across the 3 concepts. The problem posed by using ad-hoc surveys is that there is no coherence across studies in the assessment of technology acceptability, acceptance, and adoption. The lack of standardised tools to assess these concepts is what probably motivates researchers to create their own assessment tools. This contributes to blurring even more the differences between concepts. More standardised tools are needed if we aim to have objective and coherent measures of the user perception of technology at the different stages of their journey.

Despite the existence of definitions cited earlier, we observe that a large part of the literature uses the terms technology *acceptability*, *acceptance* and *adoption* interchangeably [4], or in place of other concepts such as user satisfaction [3] or engagement [19]. This creates a confusion about the meaning of these terms and blurs the differences that exist between the 3 constructs. For example, many studies stating that they measure a system's acceptability (i.e. participants' perception before the use) in reality measure longer term usage, and so acceptability or adoption may be more appropriate terms. The way a study describes what it measures is crucial for a good understanding of their results and for comparing them to those of similar studies. In turn, this terminological confusion creates a misunderstanding of the user's relationship with technology over time.

Table 2: Measurements performed.
[Studies that use terms interchangeably are excluded from this table. Some studies performed several measurements.]

Measurement	# of studies	Frequency (%)
Acceptability	4 studies	
Standardised survey	2	(50%)
Custom survey	3	(75%)
Acceptance	5 studies	
Standardised survey	2	(40%)
Custom survey	2	(40%)
Completion of task	1	(20%)
Adoption	16 studies	
Standardised survey	4	(25%)
Custom survey	9	(56%)
Usage	3	(19%)
Qualitative feedback	1	(6%)

CONCLUSION AND DISCUSSION

The preliminary analysis presented in this paper shows that researchers associate different meanings to the concepts of technology *acceptability*, *acceptance*, and *adoption*, and sometimes refer to them interchangeably. Relatively few studies refer to literature definitions or models to support their understanding of the concepts. However, we also found that the literature models and definitions are understood in different ways and sometimes used in discussion of concepts that they do not cover well. The fact that a large number of studies give their own definition of the concepts shows that the definitions offered by the literature are not widely known or used. Similarly, the lack of standardised measurement tools lead researchers to develop their own assessment tools, which illustrates the difficulties faced by researchers in objectively measuring the level of acceptability, acceptance and adoption of technologies and makes it difficult to compare the results of related studies. We believe that a common and coherent terminology and standardised measurement tools are key to address the issue of technology acceptance as a community and hope that studies like this one will bring us closer to an accepted set of definitions and assessment framework.

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