

TABLE 1:THE COMPLETE LIST OF IDENTIFIED UX ASPECTS, ATTRIBUTES, AND ASSOCIATED MEASUREMENT METHODSⁱ.

Aspect	Attributes	Assessment Methods for Aspects/Attribute ⁱⁱ _s	Methods Category
Learnability	Simplicity [S19]	-	-
	Navigability [S19]	-	-
	Self-Descriptiveness [S19]	-	-
	Memorability [S19]	-	-
	Consistency [S19]	-	-
	Guidance [S19]	-	-
		Automated Evaluation [S140]	ALL
		SUXES Method [S130]	Expert Evaluation
		Questionnaire [S131] [S165] [S176]	Self-Reported Measurement
		Observation [S165]	Observational Measurement
		Interview [S131]	Self-Reported Measurement
		Ease Of Use Questionnaire (USE) [S79]	Self-Reported Measurement
Usability	Attractiveness [S7] [S30] [S33] [S118] [S161]	Fuzzy Association Rule Mining [S7]	All
		Questionnaire [S30] [S33] [S161]	Self-Reported Measurement
	Effectiveness [S7] [S12] [S23] [S25] [S30] [S33] [S35] [S36] [S41] [S44] [S46] [S54] [S61] [S65] [S69] [S74] [S82] [S90] [S118] [S97] [S98] [S120] [S125] [S129] [S145] [S146] [S147] [S149] [S154] [S155] [S156] [S172]	Fuzzy Association Rule Mining [S7]	All
		User Testing [S12] [S23] [S35] [S41] [S46] [S61] [S65] [S69] [S74] [S82] [S97] [S125] [S145] [S146] [S147] [S156]	All
		Analyzing User Reviews [S44]	Self-Reported Measurement
		Cognitive Walkthrough [S54]	Expert Evaluation
		Usability Metric For User Experience (UMUX) Scale [S98]	Self-Reported Measurement
		USE Questionnaire [S120]	Self-Reported Measurement
		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		Observation [S155]	Observational Measurement
		Think Aloud [S155]	Self-Reported Measurement
		Interview [S172]	Self-Reported Measurement
		Questionnaire [S25] [S30] [S33]	Self-Reported Measurement
	Efficiency [S7] [S12] [S22] [S23] [S25] [S30] [S32] [S33] [S35] [S36] [S44] [S46] [S50] [S54] [S61] [S65] [S69] [S74] [S82] [S90] [S97] [S98] [S118] [S120] [S125] [S129] [S132] [S133]	Usability Metric For User Experience (UMUX) Scale [S98]	Self-Reported Measurement
		Fuzzy Association Rule Mining [S7]	All
		User Testing [S12] [S23] [S32] [S35] [S46] [S54] [S61] [S65] [S69] [S74] [S82] [S97] [S125] [S145] [S146] [S147] [S156]	All
		USE Questionnaire [S120]	Self-Reported Measurement

	[S141] [S145] [S146] [S147] [S149] [S154] [S155] [S156] [S170] [S179]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Observation [S155]	Observational Measurement
		Think Aloud [S155]	Self-Reported Measurement
		Questionnaire [S22] [S25] [S30] [S33] [S141]	Self-Reported Measurement
	Assistance [S7] [S33] [S55] [S132] [S133] [S141] [S170] [S179]	Fuzzy Association Rule Mining [S7]	All
		Analyzing User Reviews [S55]	Self-Reported Measurement
		Questionnaire [S33] [S141]	Self-Reported Measurement
	Operability [S7] [S30] [S33] [S44]	Fuzzy Association Rule Mining [S7]	All
		Analyzing User Reviews [S44]	Self-Reported Measurement
		Questionnaire [S30] [S33]	Self-Reported Measurement
	Reliability [S7] [S33]	Fuzzy Association Rule Mining [S7]	All
		Questionnaire [S33]	Self-Reported Measurement
	Learnability [S7] [S12] [S22] [S23] [S30] [S32] [S33] [S35] [S36] [S38] [S41] [S44] [S55] [S71] [S90] [S97] [S118] [S120] [S125] [S129] [S132] [S133] [S141] [S149] [S170] [S179]	Fuzzy Association Rule Mining [S7]	All
		User Testing [S12] [S23] [S32] [S35] [S41] [S97] [S125]	All
		USE Questionnaire [S38] [S71] [S120]	Self-Reported Measurement
		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Questionnaire [S22] [S30] [S33] [S141]	Self-Reported Measurement
	Satisfaction [S7] [S12] [S13] [S14] [S17] [S22] [S25] [S30] [S32] [S33] [S35] [S36] [S38] [S44] [S46] [S52] [S55] [S61] [S65] [S69] [S71] [S74] [S82] [S94] [S97] [S98] [S106] [S118] [S120] [S125] [S137] [S145] [S146] [S147] [S154] [S155] [S156]	Fuzzy Association Rule Mining [S7]	All
		Questionnaire [S12] [S17] [S22] [S25] [S30] [S32] [S33] [S35] [S46] [S97] [S125] [S155]	Self-Reported Measurement
		USE Questionnaire [S38] [S71] [S82] [S120]	Self-Reported Measurement
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Questionnaire For User Interface Satisfaction (QUIS) [S13]	Self-Reported Measurement
		Usability Metric For User Experience (UMUX) Scale [S98]	Self-Reported Measurement
		System Usability Scale (SUS) [S14] [S52] [S61] [S65] [S74] [S94] [S106] [S147]	Self-Reported Measurement
		Interview [S145] [S146]	Self-Reported Measurement
		User Testing [S69] [S137] [S156]	All
	Understandability [S7] [S30] [S33] [S40] [S118] [S161]	Fuzzy Association Rule Mining [S7]	All
		Questionnaire [S30] [S33] [S40] [S161]	Self-Reported Measurement
	Memorability [S12] [S22] [S23] [S32] [S35] [S36]	User Testing [S12] [S23] [S32] [S35] [S97]	All
		USE Questionnaire [S120]	Self-Reported Measurement

	[S44] [S55] [S118] [S97] [S120] [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Questionnaire [S22]	Self-Reported Measurement
	Errors [S12] [S22] [S23] [S28] [S32] [S35] [S36] [S44] [S118] [S54] [S97] [S120]	User Testing [S12] [S23] [S32] [S35] [S54] [S97]	All
		Analyzing User Reviews [S44]	Self-Reported Measurement
		USE Questionnaire [S120]	Self-Reported Measurement
		Questionnaire [S22]	Self-Reported Measurement
	Cognitive Load [S12] [S23] [S35] [S36] [S44] [S55] [S97] [S118]	User Testing [S12] [S23] [S97]	All
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		NASA TLX Questionnaire [S35]	Self-Reported Measurement
	Appearance [S108]	Questionnaire [S108]	Self-Reported Measurement
	Aesthetics [S17] [S25] [S40] [S55] [S109] [S118] [S161]	Analyzing User Reviews [S55]	Self-Reported Measurement
		Interview [S109]	Self-Reported Measurement
		Questionnaire [S17] [S25] [S40] [S161]	Self-Reported Measurement
	Ease Of Use [S17] [S38] [S40] [S44] [S55] [S71] [S120] [S125] [S132] [S133] [S141]	USE Questionnaire [S38] [S71] [S120]	Self-Reported Measurement
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Questionnaire [S17] [S40] [S125] [S141]	Self-Reported Measurement
	Functionality [S25] [S28] [S55] [S109]	Questionnaire [S25]	Self-Reported Measurement
		Analyzing User Reviews [S44] [S55]	Self-Reported Measurement
		Interview [S109]	Self-Reported Measurement
		Heuristic Evaluation [S28]	Expert Evaluation
	Data Accuracy [S25]	Questionnaire [S25]	Self-Reported Measurement
	Navigability [S28] [S55] [S161]	Questionnaire [S161]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Controllability [S28] [S55] [S172] [S132] [S133] [S141] [S170] [S179]	User Testing [S172]	ALL
		Questionnaire [S141]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Performance [S28] [S118] [S172]	User Testing [S172]	ALL
	Responsiveness [S31] [S108]	Questionnaire [S108]	Self-Reported Measurement
	Quality Of Content [S31]	-	-
	Usefulness [S38] [S40] [S55] [S71] [S118] [S120]	Questionnaire [S40]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
		USE Questionnaire [S38] [S71] [S120]	Self-Reported Measurement
	Readability [S40] [S55]	Analyzing User Reviews [S55]	Self-Reported Measurement
		Questionnaire [S40]	Self-Reported Measurement

	Consistency [S55] [S161]	Questionnaire [S40] [S161]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Security [S55] [S118]	Analyzing User Reviews [S55]	Self-Reported Measurement
	Privacy [S55]	Analyzing User Reviews [S55]	Self-Reported Measurement
	Personalization [S55] [S119] [S137]	Questionnaire [S119]	Self-Reported Measurement
		User Testing [S137]	All
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Customizability [S161]	Questionnaire [S161]	Self-Reported Measurement
	Flexibility [S55] [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Error Tolerance/Handling [S55] [S108] [S149]	Questionnaire [S108]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Simplicity [S55] [S97] [S118] [S179]	User Testing [S97]	All
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Feedback [S55] [S161] [S172]	Questionnaire [S161] [S172]	Self-Reported Measurement
		Analyzing User Reviews [S55]	Self-Reported Measurement
	Comprehensibility [S118]	-	-
	Engagement [S149]	-	-
	Productivity [S118]	-	-
	Trustworthiness [S118]	-	-
	Universality [S118]	-	-
	Accessibility [S118]	-	-
	Enjoyment [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
	Informativeness [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
	Motivating [S161]	Questionnaire [S161]	Self-Reported Measurement
		Eye Tracking [S1]	Physiological Measurement
		EEG Signal Recognition [S1]	Physiological Measurement
		Mecue Questionnaire [S8]	Self-Reported Measurement
		Cognitive Walkthrough [S108]	Expert Evaluation
		Heuristic Evaluation [S11] [S13] [S51] [S62] [S88] [S103] [S111] [S122] [S124] [S156] [S169] [S171]	Expert Evaluation
		User Testing [S13] [S105] [S112] [S115] [S165] [S167]	All
		Analyzing User Reviews [S113] [S136]	Self-Reported Measurement
		System Usability Scale (SUS) [S41] [S42] [S60] [S63] [S67] [S68] [S105] [S111] [S112] [S124] [S144]	Self-Reported Measurement

		The Attrakdiff Questionnaire [S75]	Self-Reported Measurement
		IBM Computer Usability Satisfaction Questionnaires (CSUQ) [S80]	Self-Reported Measurement
		Questionnaire Of User Interface Satisfaction (QUIS) [S112]	Self-Reported Measurement
		Observation [S87]	Observational Measurement
		Questionnaire [S96] [S110] [S116] [S121] [S160] [S173] [S176]	Self-Reported Measurement
		Interview [S121] [S124] [S146]	Self-Reported Measurement
		Focus Group [S105] [S146]	Observational Measurement
		AUTOMATED USABILITY EVALUATION [S108]	ALL
		Game User Experience Satisfaction Scale (GUESS) [S164]	Self-Reported Measurement
		Think Aloud [S14] [S103] [S112] [S181]	Self-Reported Measurement
Cost		Analyzing User Reviews [S136] [S114]	Self-Reported Measurement
Emotional	Attractiveness [S9] [S39] [S47] [S64] [S72] [S185]	Questionnaire [S39] [S47] [S64]	Self-Reported Measurement
	Enjoyment [S9] [S21] [S39] [S47] [S64] [S137] [S185]	User Testing [S137]	All
		Questionnaire [S21] [S39] [S47] [S64]	Self-Reported Measurement
	Satisfaction [S9] [S185] [S57]	-	-
	Motivating [S9] [S185]	-	-
	Aesthetics [S21]	-	-
	Functionality [S21]	Questionnaire [S21]	Self-Reported Measurement
	Responsiveness [S21] [S57]	Questionnaire [S21]	Self-Reported Measurement
	Fault Tolerance [S21]	Questionnaire [S21]	Self-Reported Measurement
	Impressive [S27]	-	-
	Fulfillment [S39] [S47] [S64]	Questionnaire [S39] [S47] [S64]	Self-Reported Measurement
	Reliability [S137]	User Testing [S137]	All
	Met Expectations [S57]	Questionnaire [S57]	Self-Reported Measurement
		Questionnaire [S6] [S18] [S96] [S98] [S128] [S176] [S181] [S102] [S86] [S168] [S57]	Self-Reported Measurement
		Game Experience Questionnaire [S106]	Self-Reported Measurement
		Self-Assessment-Manikin (SAM) Questionnaire [S144]	Self-Reported Measurement
		MECUE Questionnaire [S8] [S143]	Self-Reported Measurement
		Interview [S48] [S181]	Self-Reported Measurement
		Emocard Method [S130]	Expert Evaluation

		Self-Assessment-Manikin (SAM) Questionnaire [S175]	Self-Reported Measurement
		Heart Rate Electrodermal Activity (EDA) [S175]	Physiological Measurement
		Electromyography (EMG) [S175]	Physiological Measurement
		Analyzing User Reviews [S136] [S44]	Self-Reported Measurement
		Observation [S184]	Observational Measurement
		Think Aloud [S184]	Self-Reported Measurement
		User Testing [S34] [S104] [S181]	All
Security	Privacy [S138]	-	-
	Copyright Protection [S138]	-	-
	Payment Security [S138]	-	-
Style	Minimalist Style [S1]	-	-
Subjective Quality	Recommended [S2] [S114] [S146]	Mobile App Rating Scale (MARS) [S2] [S146]	Self-Reported Measurement
		Analyzing User Reviews [S114]	Self-Reported Measurement
	Intention To Use [S2] [S98] [S146]	Questionnaire [S98]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S2] [S146]	Self-Reported Measurement
	User Rating [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Cost [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	User Needs [S3] [S114] [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
		Analyzing User Reviews [S114]	Self-Reported Measurement
		Analytic Hierarchy Process (AHP) [S3]	ALL
	Loyalty [S3] [S84]	Analytic Hierarchy Process (AHP) [S3]	ALL
	Enjoyment [S3] [S170] [S179]	Analytic Hierarchy Process (AHP) [S3]	ALL
	Presence [S45] [S96]	Questionnaire [S96]	Self-Reported Measurement
	Mental State [S45]	-	-
	Emotional [S45]	-	-
	Knowledge [S45] [S146]	Mobile App Rating Scale (MARS) [S146]	Self-Reported Measurement
	Expectations [S45]	-	-
	Involvement [S45]	-	-
	Novelty [S45]	-	-
	Aesthetics [S45]	-	-
	Technology Acceptance [S45] [S96]	Questionnaire [S96]	Self-Reported Measurement
	Trustworthiness [S45]	-	-
	Values [S84] [S136] [S170] [S179]	Questionnaire [S84]	Self-Reported Measurement
	Life-Style [S84]	Questionnaire [S84]	Self-Reported Measurement

	Attitude [S84] [S93] [S146]	Mobile App Rating Scale (MARS) [S146]	Self-Reported Measurement
		Questionnaire [S84]	Self-Reported Measurement
	Judgment [S96]	Questionnaire [S96]	Self-Reported Measurement
	Self-Satisfaction [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
	User Preferences [S157]	Focus Group [S157]	Observational Measurement
	Attachment [S132] [S133] [S141] [S170] [S179] [S182]	Questionnaire [S141]	Self-Reported Measurement
	Sociability [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
	Motivating [S164] [S45]	Game User Experience Satisfaction Scale (GUESS) [S164]	Self-Reported Measurement
	Culture [S45] [S114]	Analyzing User Reviews [S114]	Self-Reported Measurement
Engagement	Interesting [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Customizability [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Responsiveness [S2] [S162]	Interview [S162]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Motivating [S162]	Interview [S162]	Self-Reported Measurement
		Analyzing User Reviews [S44]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S146]	Self-Reported Measurement
		Expert Evaluation [S139]	Expert Evaluation
		Focus Group [S157]	Observational Measurement
		Questionnaire [S168] [S176]	Self-Reported Measurement
Functionality		User Testing [S34]	All
	Performance [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Ease Of Use [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Navigability [S2] [S162]	Interview [S162]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Effectiveness [S185]	-	-
	Efficiency [S9] [S185]	-	-
	Convenience [S9] [S185]	-	-
	Gesture Interaction [S9] [S185] [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Guidance [S162]	Interview [S162]	Self-Reported Measurement
	Customizability [S162]	Interview [S162]	Self-Reported Measurement
	Aesthetics [S162]	Interview [S162]	Self-Reported Measurement
	Responsiveness [S162]	Interview [S162]	Self-Reported Measurement
		Questionnaire [S43] [S128]	Self-Reported Measurement

		Expert Evaluation [S139]	Expert Evaluation
		Observation [S87]	Observational Measurement
		Analyzing User Reviews [S114]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S146]	Self-Reported Measurement
		Analytic Hierarchy Process (AHP) [S3]	ALL
Affordances	Consistency [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Error Handling [S2]		
	Shortcut Offerings [S2]		
	Controllability [S2]		
	Memorability [S2]		
Safety	Reversal Of Actions [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Accessibility [S2]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Fault Tolerance [S19]	-	-
	Security [S19]	-	-
	Privacy [S19]	-	-
	Accuracy [S19]	-	-
Aesthetics	Layout [S2] [S3] [S175]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Text [S185]	-	-
	Graphics [S2] [S175] [S185]	Mobile App Rating Scale (MARS) [S2]	Self-Reported Measurement
	Color [S3] [S175] [S185] [S101] [S132] [S133] [S141] [S170] [S179]	Questionnaire [S141]	Self-Reported Measurement
		Analytic Hierarchy Process (AHP) [S3]	ALL
	Audio [S9] [S185]	Questionnaire [S84]	Self-Reported Measurement
	Immersion [S84]	Questionnaire [S84]	Self-Reported Measurement
	Inspirational [S84]	Questionnaire [S84]	Self-Reported Measurement
	Enjoyment [S84]	Questionnaire [S84]	Self-Reported Measurement
	Liveliness [S84]	Questionnaire [S84]	Self-Reported Measurement
		Mecue Questionnaire [S8]	Self-Reported Measurement
		Questionnaire [S10] [S76] [S110] [S121] [S128] [S142] [S158]	Self-Reported Measurement
		Analyzing User Reviews [S44] [S114]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S100] [S144]	Self-Reported Measurement
		Expert Evaluation [S139]	Expert Evaluation
		Interview [S121] [S144]	Self-Reported Measurement
		Automated Evaluation [S140]	All
		Focus Group [S157]	Observational Measurement
		Think Aloud [S144]	Self-Reported Measurement

		Mobile App Rating Scale (MARS) [S146]	Self-Reported Measurement
		Game User Experience Satisfaction Scale (GUESS) [S164]	Self-Reported Measurement
		User Testing [S34] [S101]	ALL
Quality Of Interaction	Understandability [S3]	Analytic Hierarchy Process (AHP) [S3]	ALL
	Enjoyment [S3]	Analytic Hierarchy Process (AHP) [S3]	ALL
	Friendly [S42] [S135] [S182] [S187] [S39] [S47] [S56] [S64]	Questionnaire [S42] [S187] [S39] [S47] [S56] [S64]	Self-Reported Measurement
	Ease Of Use [S42]	Questionnaire [S42]	Self-Reported Measurement
	Flexibility [S42]	Questionnaire [S42]	Self-Reported Measurement
	Novelty [S42]	Questionnaire [S42]	Self-Reported Measurement
	Personalization [S69]	User Testing [S69]	All
	Adaptability [S69]	User Testing [S69]	All
	Controllability [S69]	User Testing [S69]	All
	Trustworthiness [S69]	User Testing [S69]	All
	Efficiency [S84]	Questionnaire [S84]	Self-Reported Measurement
	Performance [S84]	Questionnaire [S84]	Self-Reported Measurement
	Perspicuity [S42] [S135]	Questionnaire [S42]	Self-Reported Measurement
	Navigability [S135]	-	-
	Consistency [S135]	-	-
	Quality Of Output [S135]	-	-
	Responsiveness [S138]	-	-
	Fault Tolerance [S135]	-	-
	Interesting [S135]	-	-
		Questionnaire [S123] [S176]	Self-Reported Measurement
Application Assistances	Mobile Devices [S3]	Analytic Hierarchy Process (AHP) [S3]	ALL
	Operation System [S3]		
	Internet Speed [S3]		
Context	Temporal Context [S45] [S85] [S114]	Analyzing User Reviews [S114]	Self-Reported Measurement
		UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement
	Social Context [S45] [S85] [S92] [S99]	UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement
	Internal Context [S85]	UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement
	Perceived Resources [S85]	UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement
	Task Context [S85] [S92] [S99]	UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement
	Physical Context [S45] [S85] [S92] [S99]	UX Context Scale (UXCS) Questionnaire [S85]	Self-Reported Measurement

	App Version [S114]	Analyzing User Reviews [S114]	Self-Reported Measurement
	Device Model [S114]	Analyzing User Reviews [S114]	Self-Reported Measurement
		Analytic Hierarchy Process (AHP) [S3]	ALL
Performance	Effectiveness [S123]	User Testing [S123]	All
	Efficiency [S123]	User Testing [S123]	All
		Analyzing User Reviews [S114]	Self-Reported Measurement
		User Testing [S4] [S60] [S104]	ALL
Attractiveness	Pleasant [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Friendly [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Enjoyment [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
		Questionnaire [S18] [S165] [S186] [S141]	Self-Reported Measurement
		Observation [S165]	Observational Measurement
		Analyzing User Reviews [S114]	Self-Reported Measurement
		Enjoyment Curve [S99]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S50] [S75] [S110] [S147] [S150]	Self-Reported Measurement
		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S126] [S151] [S152] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement

Stimulation	Exciting [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Interesting [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Connective [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Professional [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Inventive [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Simplicity [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Likeability [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Pleasant [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Practical [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
		Questionnaire [S18] [S168]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S50] [S75] [S100] [S110] [S144]	Self-Reported Measurement
Novelty		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S117] [S126] [S151] [S152] [S156] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement
		Questionnaire [S84]	Self-Reported Measurement
	Innovativeness [S84]		
	Uniqueness [S84]	Questionnaire [S84]	Self-Reported Measurement
		Questionnaire [S168] [S186] [S187] [S39] [S47] [S56] [S64] [S72]	Self-Reported Measurement

		UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S117] [S126] [S115] [S151] [S152] [S156] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement
Dependability		UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Assistance [S95]		
		Questionnaire [S10] [S168] [S186]	Self-Reported Measurement
		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S117] [S126] [S145] [S151] [S152] [S156] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement
Efficiency	Time Behavior [S19]	-	-
	Resource Utilization [S19]	-	-
	Memorability [S19]	-	-
	Navigability [S19] [S27]	-	-
	Operability [S19]	-	-
	Simplicity [S19]	-	-
	Responsiveness [S19]	-	-
	Layout [S27]	-	-
	Convenient [S27]	-	-

	Searchability [S27]	-	-
	Speed [S42] [S95]	Questionnaire [S42]	Self-Reported Measurement
		UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Conciseness [S27]	-	-
	Accessibility [S131]	Questionnaire [S131]	Self-Reported Measurement
	Portability [S131]	Interview [S131]	Self-Reported Measurement
		Questionnaire [S165] [S186] [S187] [S39] [S47] [S56] [S64]	Self-Reported Measurement
		Observation [S165]	Observational Measurement
		Automated Evaluation [S140]	All
Perspicuity		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S117] [S126] [S115] [S142] [S151] [S152] [S156] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement
	Understandability [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
	Simplicity [S95]	UEQ-Emoji Questionnaire [S95]	Self-Reported Measurement
		Questionnaire [S10] [S168] [S186]	Self-Reported Measurement
		SUXES Method [S130]	Expert Evaluation
Meaningfulness		User Experience Questionnaire (UEQ) [S5] [S16] [S20] [S24] [S29] [S32] [S49] [S52] [S53] [S61] [S73] [S77] [S78] [S81] [S87] [S89] [S94] [S99] [S117] [S126] [S145] [S151] [S152] [S156] [S167] [S169] [S178] [S180] [S189]	Self-Reported Measurement
		Questionnaire [S6] [S144]	Self-Reported Measurement
Usefulness	Information Quality [S138]	-	-
	Timeliness [S138]	-	-
	Integrity [S138]	-	-
		Questionnaire [S10] [S116] [S121] [S128] [S145] [S158] [S165] [S187] [S39] [S47] [S56] [S64]	Self-Reported Measurement
		Interview [S121] [S145]	Self-Reported Measurement
		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation

		Ease Of Use Questionnaire (USE) [S79]	Self-Reported Measurement
		Analyzing User Reviews [S136]	Self-Reported Measurement
		SUXES Method [S130]	Expert Evaluation
		Hedonic Usefulness Scale [S150]	Self-Reported Measurement
		Intrinsic Motivation Inventory (IMI) Scale [S159]	Self-Reported Measurement
		Observation [S165]	Observational Measurement
		MECUE Questionnaire [S8]	Self-Reported Measurement
		Questionnaire [S76] [S100]	Self-Reported Measurement
Loyalty		MECUE Questionnaire [S8]	Self-Reported Measurement
App Status		MECUE Questionnaire [S8]	Self-Reported Measurement
Cognitive	Complexity [S9] [S185]	-	-
	Learnability [S9] [S185]	-	-
	Memorability [S9] [S185]	-	-
	Comprehensibility [S39] [S47] [S64]	Questionnaire [S39] [S47] [S64]	Self-Reported Measurement
	Engagement [S39] [S47] [S64]	Questionnaire [S39] [S47] [S64]	Self-Reported Measurement
	Meaningfulness [S39] [S47] [S64]	Questionnaire [S39] [S47] [S64]	Self-Reported Measurement
	Mental Mapping [S72]	Questionnaire [S84]	Self-Reported Measurement
	Group Cognition [S72]	Questionnaire [S84]	Self-Reported Measurement
	Ease Of Use [S84]	Questionnaire [S84]	Self-Reported Measurement
	Flexibility [S84]	Questionnaire [S84]	Self-Reported Measurement
	Consistency [S84]	Questionnaire [S84]	Self-Reported Measurement
	Perspicuity [S84]	Questionnaire [S84]	Self-Reported Measurement
		Questionnaire [S142]	Self-Reported Measurement
Guidance		Interview [S109]	Self-Reported Measurement
		Questionnaire [S10]	Self-Reported Measurement
Understandability		User Experience Questionnaire (UEQ) [S115]	Self-Reported Measurement
		Questionnaire [S10]	Self-Reported Measurement
Accuracy		Analyzing User Reviews [S114]	Self-Reported Measurement
		Questionnaire [S10]	Self-Reported Measurement
Ease Of Use		Ease Of Use Questionnaire (USE) [S79]	Self-Reported Measurement
		User Testing [S104]	All
		SUXES Method [S130]	Expert Evaluation
		Focus Group [S157]	Observational Measurement
		Observation [S165]	Observational Measurement

		Analyzing User Reviews [S114]	Self-Reported Measurement
		Questionnaire [S10] [S158] [S165]	Self-Reported Measurement
Enjoyment		Analyzing User Reviews [S44]	Self-Reported Measurement
		User Experience Questionnaire (UEQ) [S115]	Self-Reported Measurement
		Interview [S121] [S131]	Self-Reported Measurement
		SUXES Method [S130]	Expert Evaluation
		Intrinsic Motivation Inventory (IMI) Scale [S159]	Self-Reported Measurement
		Game User Experience Satisfaction Scale (GUESS) [S164]	
		Questionnaire [S10] [S76] [S98] [S102] [S121] [S127] [S128] [S131] [S187] [S39] [S47] [S56] [S64] [S72]	Self-Reported Measurement
Satisfaction	Operability [S19]	-	-
	User Preferences [S19]	-	-
	Users' Attitudes/Perceptions [S19]	-	-
	Likeability [S19]	-	-
	Guidance [S19]	-	-
	Reliability [S131]	Questionnaire [S131]	Self-Reported Measurement
		Interview [S131]	Self-Reported Measurement
	Attractiveness [S19] [S131]	Questionnaire [S131]	Self-Reported Measurement
		Interview [S131]	Self-Reported Measurement
	Simplicity [S19]	-	-
	Memorability [S19]	-	-
	Flexibility [S19]	-	-
		Ease Of Use Questionnaire (USE) [S79] [S143]	Self-Reported Measurement
		Questionnaire [S43] [S76] [S128] [S158]	Self-Reported Measurement
		Automated Evaluation [S140]	All
		User Testing [S34] [S104]	All
Pragmatic Quality	Quality Of Output [S102]	Questionnaire [S102]	Self-Reported Measurement
	Motivating [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Structure [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Manageable [S130] [S153]	Questionnaire [S153]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Immersion [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Novelty [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Accessibility [S153]	Questionnaire [S153]	Self-Reported Measurement
	Valuable [S153]	Questionnaire [S153]	Self-Reported Measurement

	Availability [S153]	Questionnaire [S153]	Self-Reported Measurement
	Context Coverage [S153]	Questionnaire [S153]	Self-Reported Measurement
	Compatibility [S153]	Questionnaire [S153]	Self-Reported Measurement
	Customizability [S153]	Questionnaire [S153]	Self-Reported Measurement
	Dependability [S153]	Questionnaire [S153]	Self-Reported Measurement
	Ease Of Use [S153]	Questionnaire [S153]	Self-Reported Measurement
	Effectiveness [S153]	Questionnaire [S153]	Self-Reported Measurement
	Efficiency [S153]	Questionnaire [S153]	Self-Reported Measurement
	Familiarity [S153]	Questionnaire [S153]	Self-Reported Measurement
	Trustworthiness [S153]	Questionnaire [S153]	Self-Reported Measurement
	Minimal Workload [S153]	Questionnaire [S153]	Self-Reported Measurement
	Perspicuity [S153]	Questionnaire [S153]	Self-Reported Measurement
	Privacy [S153]	Questionnaire [S153]	Self-Reported Measurement
	Scalability [S153]	Questionnaire [S153]	Self-Reported Measurement
		Analyzing User Reviews [S136]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S50] [S110] [S147] [S150]	Self-Reported Measurement
		Questionnaire [S160]	Self-Reported Measurement
		Heart Rate Variability (HRV) [S18]	Physiological Measurement
Hedonic Quality	Impressive [S102]	Questionnaire [S102]	Self-Reported Measurement
	Creative [S102] [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
		Questionnaire [S102]	Self-Reported Measurement
	Entertaining Intereaction [S102]	Questionnaire [S102]	Self-Reported Measurement
	Attractiveness [S130] [S153]	Questionnaire [S153]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Aesthetics [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Integration [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Predictable [S130]	The Attrakdiff Questionnaire [S130]	Self-Reported Measurement
	Identification [S147] [S150] [S173]	Questionnaire [S173]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S147] [S150]	Self-Reported Measurement
	Stimulation [S147] [S150] [S153] [S173]	Questionnaire [S153] [S173]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S147] [S150]	Self-Reported Measurement
	Novelty [S153]	Questionnaire [S153]	Self-Reported Measurement
	Satisfaction [S153]	Questionnaire [S153]	Self-Reported Measurement
	Emotional [S160]	Questionnaire [S160]	Self-Reported Measurement
	Engagment [S160]	Questionnaire [S160]	Self-Reported Measurement

	Sociality[S160]	Questionnaire [S160]	Self-Reported Measurement
		Analyzing User Reviews [S44] [S136]	Self-Reported Measurement
		The Attrakdiff Questionnaire [S50]	Self-Reported Measurement
		Questionnaire [S18]	Self-Reported Measurement
Identity		The Attrakdiff Questionnaire [S75] [S147]	Self-Reported Measurement
		Questionnaire [S18]	Self-Reported Measurement
Effectiveness	Responsiveness [S19]	-	-
	Memorability [S19]	-	-
	Accuracy [S19]	-	-
	Consistency [S19]	-	-
	Completeness [S19]	-	-
	Flexibility [S19]	-	-
	Quality Of Output [S19] [S42]	Questionnaire [S42]	Self-Reported Measurement
	Navigability [S19]	-	-
	Reliability [S27]	-	-
	Functionality [S27]	-	-
	Simplicity [S131]	Questionnaire [S131]	Self-Reported Measurement
		Interview [S131]	Self-Reported Measurement
		Game Experience Questionnaire [S106]	Self-Reported Measurement
		User Testing [S34]	All
		The Perceived Persuasiveness Scale (PPS) [S159]	Self-Reported Measurement
		Automated Evaluation [S140]	All
		Observation [S165]	Observational Measurement
		Questionnaire [S43] [S127] [S142] [S165]	Self-Reported Measurement
Accessibility	Operability [S19]	-	-
	Simplicity [S19]	-	-
	Memorability [S19]	-	-
	Navigability [S19]	-	-
	Guidance [S19]	-	-
	Consistency [S19]	-	-
	Self-Descriptiveness [S19]	-	-
	Controllability [S19]	-	-
	Readability [S19]	-	-
	Simplicity [S19]	-	-

	Customizability [S69]	-	-
	Flexibility [S19]	-	-
		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		Questionnaire [S142] [S165]	Self-Reported Measurement
		Observation [S165]	Observational Measurement
		Automated Evaluation [S88]	ALL
Personalization	Responsiveness [S19]	-	-
	Memorability [S19]	-	-
	Flexibility [S19]	-	-
	Attractiveness [S19]	-	-
	Self-Descriptiveness [S19]	-	-
	Controllability [S19]	-	-
	Readability [S19]	-	-
	Navigability [S19]	-	-
	Simplicity [S19]	-	-
	Guidance [S19]	-	-
	Consistency [S19]	-	-
		Analyzing User Reviews [S114]	Self-Reported Measurement
		User Experience Questionnaire (UEQ) [S115]	Self-Reported Measurement
Devices Limitations		-	-
Assistance		Analyzing User Reviews [S44] [S114]	Self-Reported Measurement
		Questionnaire [S60] [S142] [S39] [S47] [S56] [S64] [S72]	Self-Reported Measurement
		User Testing [S41]	All
Auto-Sign In		-	-
Integration		-	-
Interface Design	Attractiveness [S135]	-	-
	Reasonable Visuals [S135]	-	-
	Reasonably Colorful [S135]	-	-
	Diversification Of Interface Materials [S135]	-	-
	Personalization [S135]	-	-
Infrastructure		Questionnaire [S128]	Self-Reported Measurement
Trustworthiness	Safety [S57]	Questionnaire [S57]	Self-Reported Measurement

	Dependability [S57]	Questionnaire [S57]	Self-Reported Measurement
	Brand Trustworthiness [S57]	Questionnaire [S57]	Self-Reported Measurement
	Content Truthfulness [S57]	Questionnaire [S57]	Self-Reported Measurement
		Analyzing User Reviews [S44]	Self-Reported Measurement
		Questionnaire [S128] [S145]	Self-Reported Measurement
		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
		User Testing [S34]	All
Reliability	Security [S31]	-	-
	Privacy [S31]	-	-
	Dependability [S31]	-	-
	Robustness [S31]	-	-
	Trustworthiness [S31]	-	-
		Questionnaire [S39] [S47] [S56] [S64]	Self-Reported Measurement
Customizability		User Testing [S34]	All
Information Quality	Completeness [S37]	-	-
	Accuracy [S37]	-	-
	Format [S37]	-	-
	Understandability [S37]	-	-
		Expert Evaluation [S139]	Expert Evaluation
		Questionnaire [S158]	Self-Reported Measurement
		Mobile App Rating Scale (MARS) [S2] [S146]	Self-Reported Measurement
Communicativeness		Questionnaire [S39] [S47] [S56] [S64]	Self-Reported Measurement
Right Objects		-	-
Zoom In/Out		-	-
Identification		The Attrakdiff Questionnaire [S100] [S110] [S144]	Self-Reported Measurement
Co-Experience		Questionnaire [S144]	Self-Reported Measurement
Effort		Intrinsic Motivation Inventory (IMI) Scale [S159]	Self-Reported Measurement
		Questionnaire [S60]	Self-Reported Measurement
Consistency		-	-
Sequence		-	-

Responsiveness		Questionnaire [S142] [S10] [S145] [S39] [S47] [S56] [S64]	Self-Reported Measurement
Error Prevention		-	-
Error Handling		-	-
Navigability		Questionnaire [S96]	Self-Reported Measurement
		Game Experience Questionnaire [S106]	Self-Reported Measurement
		Focus Group [S157]	Observational Measurement
		Observation [S87]	Observational Measurement
Controllability		Questionnaire [S176]	Self-Reported Measurement
Independence		-	-
Uniqueness		Questionnaire [S76]	Self-Reported Measurement
Mental Workload	Mental Demand [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
	Physical Demand [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
	Temporal Demand [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
	Performance [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
	Effort [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
	Frustration Level [S80] [S91]	NASA TLX Questionnaire [S80] [S91]	Self-Reported Measurement
Quality Of Content	Text [S87]	Observation [S87]	Observational Measurement
	Photos [S87]	Observation [S87]	Observational Measurement
	Data [S87]	Observation [S87]	Observational Measurement
	Authoritative Resources [S135]	-	-
	Availability Of Resources [S135]	-	-
	Diversification Of Resources [S135]	-	-
	Reasonable Structure [S135]	-	-
		Questionnaire [S121]	Self-Reported Measurement
		Interview [S109] [S121]	Self-Reported Measurement
Bug/Crash		Analyzing User Reviews [S114]	Self-Reported Measurement
Network		Analyzing User Reviews [S114]	Self-Reported Measurement

Simplicity		Questionnaire [S141]	Self-Reported Measurement
		Analyzing User Reviews [S114]	Self-Reported Measurement
Update		Analyzing User Reviews [S114]	Self-Reported Measurement
Temporal		-	-
Collaborativeness		Questionnaire [S187] [S39] [S47] [S56] [S64] [S72]	Self-Reported Measurement
Immersion		Game Experience Questionnaire [S106]	Self-Reported Measurement
		Questionnaire [S96] [S168]	Self-Reported Measurement
Challenge		-	-
		-	-
Privacy		Analyzing User Reviews [S114]	Self-Reported Measurement
User Profile	Support Diverse User Profiles [S31]	-	-
		Analyzing User Reviews [S114]	Self-Reported Measurement
Excitement		User Experience Questionnaire (UEQ) [S115]	Self-Reported Measurement
Motivating		Intrinsic Motivation Inventory (IMI) Scale [S159]	Self-Reported Measurement
		Game Experience Questionnaire [S106]	Self-Reported Measurement
		Questionnaire [S127]	Self-Reported Measurement
Desirable	Attractiveness [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
	Emotional Engagement [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
Findability	Navigability [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
	Searchability [S129]	The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
Valuable		The Mobile Application User Experience Checklist (MAUX-C) [S129]	Expert Evaluation
Speed		SUXES Method [S130]	Expert Evaluation
Robustness		SUXES Method [S130]	Expert Evaluation
Realism		SUXES Method [S130]	Expert Evaluation
Delicacy		Questionnaire [S141]	Self-Reported Measurement
Luxuriousness		Questionnaire [S141]	Self-Reported Measurement
Availability		-	-
Stability		-	-

Convenience		Questionnaire [S142]	Self-Reported Measurement
Advertising		Analyzing User Reviews [S114]	Self-Reported Measurement
Compatibility		Analyzing User Reviews [S114]	Self-Reported Measurement
Adaptability		Questionnaire [S145]	Self-Reported Measurement
Layout		Focus Group [S157]	Observational Measurement
Creativity		-	-
Informativeness		-	-
Inspirational		-	-
Liveliness		-	-
Flexibility		-	-
Sociality		Game User Experience Satisfaction Scale (GUESS) [S164]	Self-Reported Measurement
		Questionnaire [S168]	Self-Reported Measurement
Productivity	Time Behavior [S19]	-	-
	Resource Utilization [S19]	-	-
		Questionnaire [S187] [S39] [S47] [S56] [S64]	Self-Reported Measurement

ⁱ The (ALL) keyword is presented because the method used could be classified into any of the four method categories depending on the type of procedure and data collected during the evaluation. In addition, the methods associated with the aspects without attributes beside them mean that they were used to assess the aspect in general without being specific to evaluate a particular attribute.

ⁱⁱ Methods that evaluate an aspect in general without measuring a specific attribute are provided without being associated with an attribute within each aspect in the table above.