An Instrument Development: Interactivity Survey (IS)

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ABSTRACT

Although there is no agreement as to what instructional interactivity and interaction mean in educational literature, researchers agree that both terms are vital for teaching and learning one way or another. This paper presents the item-development stages and validity and reliability analyses of the Interactivity Survey (IS), which attempts to uncover the perceptions of professors working at departments of education from universities around the world. To provide evidence of reliability of the instrument, a pilot study was carried out with a sample size of 262 universities. All of the statistical test results and the final version of the instrument were provided. Thus, this paper is both a theoretical paper that conceptually synthesizes the literature on instructional interactivity and a technical paper that considers the information from an instrument-development point of view.

Keywords

Instructional interactivity, Survey development, Instrument validity, Reliability, Learning

Introduction

Interactivity and interaction are two terms that have been used very often in the literature of science, science education, computer science, educational technology, distance education, curriculum and instruction, and psychology (Chim, Lau, Leong, & Si, 2003; Fahy, 2003; Juwah, 2003; Kirsh, 1997; Tobin, 1993; Wagner, 1994). While reporting a recent review of the literature about interactivity in computer-mediated college and university education, Muirhead and Juwah (2004), in an earlier issue of the Journal of Educational Technology and Society, emphasize that interactivity and interaction are critical in underpinning the learning process in face-to-face, campus-based and distance education.

Empirical and conceptual studies about interactivity and interaction are usually associated with operational definitions specific to the educational contexts investigated. Thus, while the importance of interactivity was emphasized in considerable studies in education (Anderson, 2002; Bork, 1982; Fahy, 2003; Fulford & Zhang, 1993; Hirumi, 2002; Jonassen, 1985, 1988; Juwah, 2003; Kahveci, 2006; Kirsh, 1997; Muirhead & Juwah, 2004; Rose, 1999; Simpson & Galbo, 1986; Sims, 1997, 2000; Wagner, 1989, 1990, 1994, 1997), there is no settled view of what it means for instruction (Kirsh, 1997). In fact, interactivity is essentially medium-specific (e.g., videodisks, distance education, educational software, etc.), somewhat arbitrary, and not very descriptive (Schwier & Misanchuk, 1993). Because of this, many unresolved questions about the nature of interactivity (Kirsh, 1997) remain. The operational definitions and given meanings are generally context-dependent, and fluctuate from one meaning to another as context changes. For example, Kirsh (1997) builds his argument on the concept of interactivity mostly as it applies to the design of multimedia learning environments along the lines of cognitive approach.

Also, due to the lack of theory to guide research, information available in the literature about the complex phenomena of interactivity and interaction is rather limited (Anglin & Morrison, 2003). In support of this issue, Sims (1997) indicates that interactivity is important but there appears to be no consensus of what interactivity actually represents or involves. Sims (2000) also claims that it is important to reassess not only the notion of interactivity but also its role in enhancing the learning process in its various forms. Moreover, Fulford and Zhang (1993) suggest that the model of motivational categories can provide a framework to research interactivity in education. Wagner (1990) also recommends that future considerations of interaction and interactivity should draw upon the results of research from the following domains: learning and learning theory, instructional theory, instructional design, and instructional delivery.

While having practical and technical meanings, the purpose of this study is to develop the IS survey to gather faculty members' perceptions about instructional interactivity. The faculty members are selected only from departments of education at various universities around the world. Thus, the expected output of the study illuminates educators' common perceptions about the meaning of instructional interactivity and/or interaction.

Developing the Interactivity Survey Items

With the IS, the research consists of five categories: the **functional definitions of interactivity**, the **existence of interactivity** in various instructional settings, the attributes of interactivity as a function of **motivation** and **learning theories**, and the **events of interactivity**. These categories will be evaluated with respect to eight predictors: gender, age, present status, highest degree obtained, geographic region, research interest in interactivity, personal learning preferences (revealed by the VARK Questionnaire originally developed by Neil Fleming [2001]; added to the IS with his permission), and department. In the Table 1, the IS items in all five sections and their sources were given. Note that further explanations will be provided about the survey items, such as the explanations in "grey" after presenting the pilot study analysis, in the following sections.

Table 1. The IS with item sources from related literature

Functional Definitions of Interactivity	
The following are the definitions of interactivity or interaction, stemming from the literature of different fields of education. Please **rank the following definitions in terms of how comprehensive you feel the definitions are with regard to covering all of the types of interactivity you feel are important in learning**, in the range of Very Comprehensive, Comprehensive, Medium Comprehensive, Somewhat Comprehensive, Not Comprehensive OR Not Applicable. If you rank any item as Not Comprehensive, please comment on it by referring to its number.	
Questions	**Sources for Question Design**
1. Interaction is all manners of behaviour, in which individuals and groups act upon each other.	"Interaction is defined as all manners of behaviour in which individuals and groups act upon each other. The essential characteristic is reciprocity in actions and responses in an infinite variety of relationships: verbal or nonverbal, conscious or unconscious, enduring or causal. Interaction is seen as a continually emerging process, as communication in its most inclusive sense" (Simpson & Galbo, 1986, p. 38).
2. Interactions are reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another.	"Interactions are reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another" (Herring, 1987; Wagner, 1994). "Interactivity refers to the activity between two organisms" (Jonassen, 1988, p. 97).
3. Interactivity is a complex, dynamic coupling between two or more intelligent parties. The nature of interaction requires cooperation, coordination of activities, power exertions over each other, and a degree of negotiation.	"If we consider examples of interactivity in daily life, our clearest examples come from social contexts: a conversation, playing a game of tennis, dancing a waltz, dressing a child, performing as a member in a quartet, reacting to the audience in improv theatre. All these highly interactive recreations teach us something about the nature of interaction. Each requires cooperation, the involved parties must coordinate their activity or else the process collapses into chaos; all parties exercise power over each other, influencing what the other will do, and usually there is some degree of (tacit) negotiation over who will do what, when and how. In these examples, interactivity is a complex, dynamic coupling between two or more intelligent parties" (Kirsh, 1997).
4. Interactivity describes a learning process in which the student and the system (i.e., computer) alternate in addressing each other. Typically, each is capable of selecting alternative actions based on the actions of the other.	"Burke (1982) claimed that interactivity describes a learning process in which the student and the system alternate in addressing each other. Typically, each is capable of selecting alternative actions based on the actions of the other (p. 195)" (As cited in Rose, 1999).
5. Interaction is typically thought of as sustained	"Interaction is typically thought of as sustained two-way

two-way communication among two or more persons for purposes of explaining and challenging perspectives.	communication among two or more persons for purposes of explaining and challenging perspectives (Garrison, 1993, p. 16)" (As cited in Berge, 1999).
6. Interactivity is the extent to which the communicator and the audience respond to, or are willing to facilitate, each other's communication needs.	Interactivity is "the extent to which the communicator and the audience respond to, or are willing to facilitate, each other's communication needs" (Ha & James, 1998, p. 461).

Existence of Interactivity in Various Instructional Settings

Which of the following educational media do you think have some forms of interactivity? Please rank all that apply. Your ideas about this question are important to understand how you perceive **interactivity** in the context of teaching and learning. There will be follow-up questions to delineate the existence of **interactivity** in these contexts.

10. Classroom.
(If selected, this item has follow-up items as given below.)

	Which of the following classroom events do you think possess interactivity? Please rank each item in the range of Very High Interactivity, High Interactivity, Medium Interactivity, Low Interactivity, Very Low Interactivity, and No Interactivity.
	10.1. Professor lecturing only.
	10.2. Professor lecturing and encouraging students to ask content related questions: Students are able to state their opinions about the content.
	10.3. Professor lecturing and giving some pauses for small group discussions: Students in small groups have discussions about the content being lectured and share their conclusions with others in class.
	10.4. Professor lecturing and promoting discussion groups to share their conclusions.

11. Computer aided teaching/learning.
(If selected, this item has follow-up items as given below.)

	The following are some computer aided teaching/learning events. **Considering the use of these events for teaching and their potential for interactivity, please rank each item** in the range of Very High Interactivity, High Interactivity, Medium Interactivity, Low Interactivity, Very Low Interactivity, and No Interactivity.
	11.1. Use of computer programs (i.e., educational software) for teaching/learning.
	11.2. Use of the Internet for teaching/learning.
	11.3. Use of presentation software (e.g., PowerPoint) and simulation programs (e.g., Java).

12. Use of Multimedia for teaching/learning.

13. Use of videodisks for teaching/learning.

14. Textbook.
(If selected, this item has follow-up items as given below.)

	In what ways can a textbook be interactive? Please rank each item in the range of Very High Interactivity, High Interactivity, Medium Interactivity, Low Interactivity, Very Low Interactivity, and No Interactivity.
	14.1. By reading textbook.
	14.2. By studying visual representations in the textbook, such as charts, diagrams, and photographs.
	14.3. By solving problems or doing concept maps while reading.

15. Laboratory (i.e., hands-on inquiries).

16. None of the items above has any degree of interactivity.

The Attribute of Interactivity as a Function of Motivation (The ARCS Theory)

Considering the function of interactivity in the process of teaching/learning, please rank each item in the range of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD).

Questions	Sources for Question Design
17. Interactivity is a strategy to learner motivation.	"If learners are not actively engaged in the instruction, they tend to become distracted and less motivated" (Fulford & Zhang, 1993).
18. Interactivity is a strategy to increase learner's participation.	
19. Interactivity should be perceived as a learning outcome rather than a generic teaching	"In the past, interaction has been treated as a generic teaching technique. Perhaps, instead, perceptions of interaction should

technique.	be treated as a desired learning outcome. Future studies should examine this possibility" (Fulford & Zhang, 1993).
Please rank each item in the range of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). **Interactivity in classroom will increase if a professor:**	
Questions	**Sources for Question Design**
Attention	
20. Captures students' attention by using unexpected approaches to teaching, such as personal experiences.	"The ARCS (Attention, Relevance, Confidence, and Satisfaction) model of motivational categories can provide a framework for designing learning strategies to increase the perception of, as well as the actual level of, interaction in the class" (Fulford & Zhang, 1993). **Perceptual Arousal:** "Create curiosity, wonderment by using novel approaches, injecting personal and/or emotional material" (Keller, 1987a).
21. Stimulates lasting curiosity with problems that invoke mystery.	**Inquiry Arousal:** "Increase curiosity by asking questions, creating paradoxes, generating inquiry, and nurturing thinking challenges" (Keller, 1987a).
22. Maintains students' attention by varying the instructional presentation.	**Variability:** "Sustain interest with variations in presentation style, concrete analogies, human interest examples, and unexpected events" (Keller, 1987a).
Relevance	
23. Emphasizes the utility of instruction by stating how instruction relates to personal goals.	**Goal Orientation:** "Provide statements or examples of the utility of the instruction, and either present goals or have learners define them" (Keller, 1987a).
24. Emphasizes the utility of instruction by having the learners determine how instruction relates to personal goals.	
25. Motivates students by providing opportunities for personal achievement (i.e., leadership responsibilities).	**Motive Matching:** "Make instruction responsive to learner motives and values by providing personal achievement opportunities, cooperative activities, leadership responsibilities, and positive role models" (Keller, 1987a).
26. Makes instruction relevant by building on learners' previous experiences.	**Familiarity:** "Make the materials and concepts familiar by providing concrete examples and analogies related to the learners' work" (Keller, 1987a).
Confidence	
27. Creates a positive expectation for success by making clear the instructional objectives.	**Learning Requirements:** "Establish trust and positive expectations by explaining the requirements for success and the evaluative criteria" (Keller, 1987a).
28. Allows learners to set their own goals.	
29. Provides opportunities for students to successfully attain challenging goals.	**Success Opportunities:** "Increase belief in competence by providing many, varied, and challenging experiences which increase learning success" (Keller, 1987a).
30. Provides learners with a reasonable degree of control over their own learning.	**Personal Control:** "Use techniques that offer personal control (whenever possible), and provide feedback that attributes success to personal effort" (Keller, 1987a). The question was designed according to Driscoll (2000, p. 331).
Satisfaction	
31. Allows learners to use newly acquired skills by providing opportunities to solve "real-world" problems.	**Natural Consequences:** "Provide problems, simulations, or work samples that allow students to see how they can now solve "real-world' problems" (Keller, 1987a).
32. Uses positive consequences such as verbal praise, real or symbolic rewards.	**Positive Consequences:** "Use verbal praise, real or symbolic rewards, and incentives, or let students present the results of their efforts ('show and tell') to reward success" (Keller, 1987a).
33. Ensures equity by providing consistent standards for all learners' tasks and	**Equity:** "Make performance requirements consistent with stated expectations, and provide consistent measurement

accomplishments.	standards for all learner's tasks and accomplishments" (Keller, 1987a).
Please rank each item in the range of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). **Advances in technology such as audio, text, and video increase interactivity:**	
Questions	**Sources for Question Design**
34. Between teachers and students.	"Current thinking suggests that, as a result of the technologically enabled exchange of audio, text, and video, greater interaction between teachers and students, among students, and between students and content is likely to ensue" (Wagner, 1994).
35. Among students.	
36. Between students and content.	
The Attribute of Interactivity as a Function of the Conditions of Learning (Gagné)	
The following events are the necessary conditions for learning according to the Conditions of Learning Theory (R. Gagné). **To achieve learning according to the Conditions of Learning, what degree of interactivity is required**? Please rank each item in the range of Very High Interactivity (VHI), High Interactivity (HI), Medium Interactivity (MI), Low Interactivity (LI), Very Low Interactivity (VLI), and No Interactivity (NI).	
Questions	**Sources for Question Design**
37. Gaining attention (reception).	The events that provide the necessary conditions for learning: **1.** gaining attention (reception) **2.** informing learners of the objective (expectancy) **3.** stimulating recall of prior learning (retrieval) **4.** presenting the stimulus (selective perception) **5.** providing learning guidance (semantic encoding) **6.** eliciting performance (responding) **7.** providing feedback (reinforcement) **8.** assessing performance (retrieval) **9.** enhancing retention and transfer (generalization). (Gagné, Briggs, & Wager, 1992)
38. Informing learners of the objective (expectancy).	
39. Stimulating recall of prior learning (retrieval).	
40. Presenting the stimulus (selective perception).	
41. Providing learning guidance (semantic encoding).	
42. Eliciting performance (responding).	
43. Providing feedback (reinforcement).	
44. Assessing performance (retrieval).	
45. Enhancing retention and transfer (generalization).	
The Events of Interactivity	
Please consider the following events of teaching. **Based on your experiences, knowledge, and beliefs in teaching, which "event or events" represent some degree of interactivity**. Please rank each item in the range of Very High Interactivity (VHI), High Interactivity (HI), Medium Interactivity (MI), Low Interactivity (LI), Very Low Interactivity (VLI), and No Interactivity (NI).	
Questions	**Sources for Question Design**
46. Teacher-centred instruction.	"...although interactivity eludes clear definition, those writing about it seem to find it easiest to explain what interactive instruction is by contrasting it with what it is not: not teacher-controlled but learner-controlled; not a lecture, in which the learner is a passive recipient of information, but an opportunity for students to engage in active, hands-on exploration, often via hypermedia technologies" (Rose, 1999, p. 44).
47. Learner-centred instruction.	
48. A lecture, in which the learner is a passive recipient of information.	
49. Active learning through hands-on exploration, often via laboratory or computer program.	
50. A lecture in which the student is spectator (i.e., a member of the audience).	"Thus, in discussing the value of interactive computer-based learning, Alfred Bork (1981) frequently reinforces central oppositions between students as spectators and as participants, between passive and active learning environments, and between the lecture and interactive computer programs (p. 275)" (As cited in Rose, 1999).
51. A lecture in which the student is a participant.	
52. A lecture based on instructionist principles (i.e., feeding students information).	"In extolling the benefits of computers in The Children's Machine, Seymour Papert (1993) constructs similar contrasts, such as that between 'instructionism' and 'constructionism' (p. 137) — that is, between feeding children information and letting them find it for themselves (p. 139)" (As cited in Rose, 1999).
53. A lecture based on constructionist principles (i.e. letting students find information for themselves).	
54. A lecture in which student absorbs material.	"And, in Growing Up Digital, Don Tapscott (1998) discusses

55. A lecture in which student learns how to learn.	interactive learning in terms of eight antithetical pairs, including 'linear' and 'hypermedia' learning, 'instruction' and 'construction,' and 'absorbing material' and 'learning how to learn' (pp. 142–149)" (As cited in Rose, 1999).

Functional definitions of interactivity

Six survey items ranging from **1** to **6**, as depicted in Table 1, were developed on the basis of functional definitions of interactivity, which were extracted from the literature covering various fields of education. The purpose of posing these items was to understand the commonalities of the perceptions in different meanings of instructional interactivity or interaction.

Investigating the existence of interactivity in various instructional settings

Items from **10** to **16** were meant to assess faculty members' perceptions of interactivity within various instructional settings. Some items contain follow-up items, for example, "Classroom." If "Classroom" was selected, the system prompts related items (i.e., **10.2** and **10.3**) as well in the following screen. This feature of the system is called "adaptive."

The attribute of interactivity as a function of motivation

Items from **17** to **36** investigate the faculty's perceptions of interactivity as a function of learner motivation. Fulford and Zhang (1993) suggest that since perceptions of interactions seem to be a critical predictor of satisfaction, specific strategies should be designed to increase these perceptions. They proposed that because perception and satisfaction are affective characteristics, the Attention, Relevance, Confidence, Satisfaction (ARCS) model of motivational categories can provide a framework for designing learning strategies to increase the perception of, as well as the actual level of, interaction in a class. Wagner (1994) further proposed that instructional theories such as Keller's ARCS Theory (1983) provide comprehensive frameworks to support a view of interactivity. The related items in the IS were derived from the principles of ARCS Model of motivation.

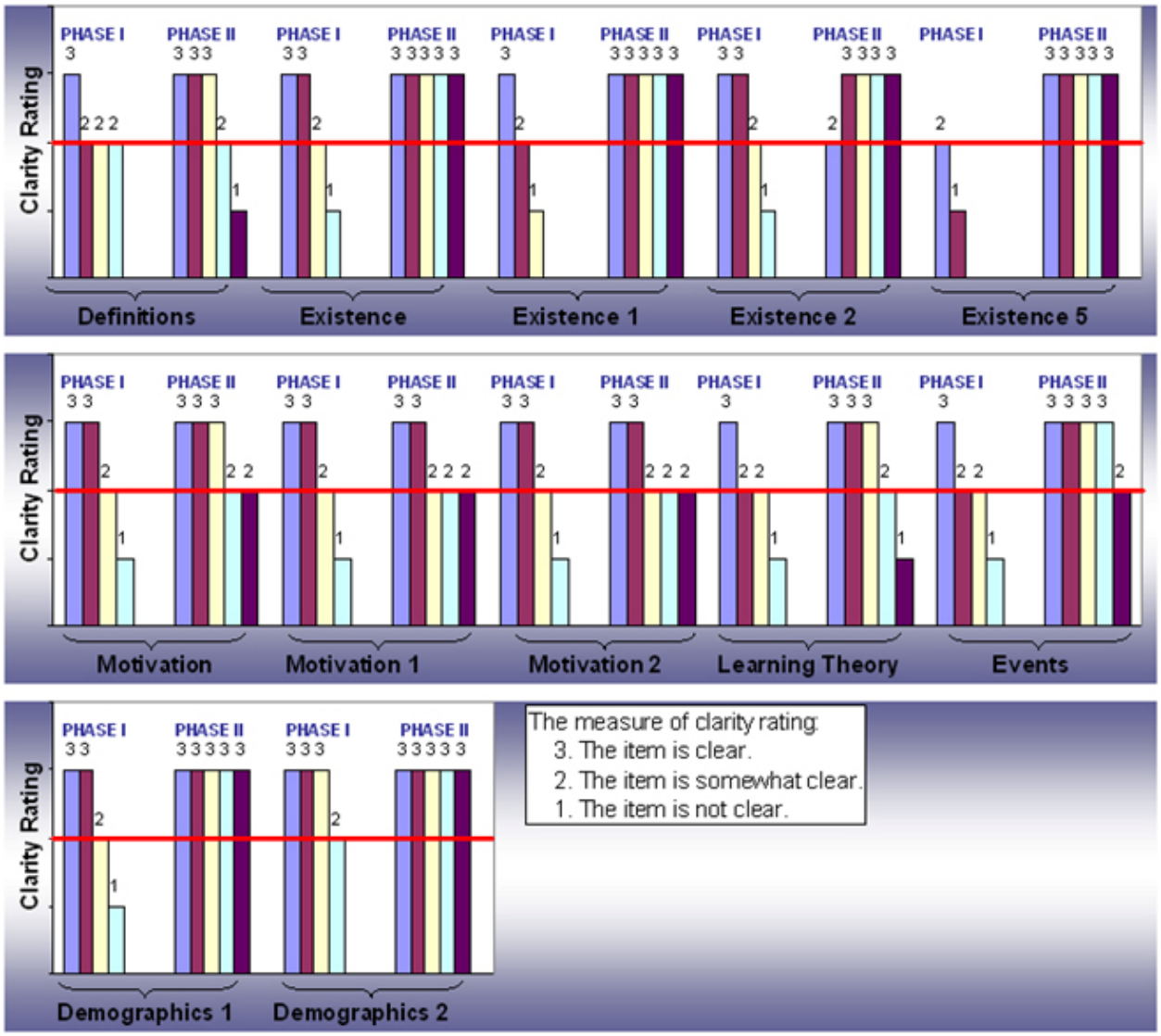
The ARCS Model describes, in four categories and their subcategories, how to understand the motivation to learn (Keller, 1987b). (See items **20** to **33** in Table 1.) The principles of the ARCS Model were presented in many early studies (Keller, 1983, 1987a, 1987b; Keller & Kopp, 1987; Keller & Suzuki, 1987).

The attribute of interactivity as a function of motivation and learning theories

In addition, Wagner (1990) suggested that future studies of interactivity should draw upon the results of research from the following domains: (1) learning and learning theory, (2) instructional theory, (3) instructional design, and (4) instructional delivery. Wagner (1994) further proposed that learning theories such as the Conditions of Learning (Gagné, 1984) — feedback, elaboration, learner control, self-regulation, and motivation — provide comprehensive frameworks to support a view of interactivity as a function of learning and instruction. That's why one of the measures of the Conditions of Learning, "the attribute of interactivity," was used to develop related items in Table 1, ranging from **37** to **45**. The Conditions of Learning was framed on the basis of cognitive psychology and information-processing conceptions. According to the information-processing model of learning and memory, learning processes follow a stage-like progression from sensory registration to long-term storage and learner performance. Events of instruction, conceived as a set of stimuli that give support to internal learning processes, accordingly follow a similar progression. These events begin with gaining attention, followed by informing the learner of the learning objective, and proceed through the stages of stimulating recall of prior learning, presenting the stimulus, providing learning guidance, eliciting performance, providing feedback, assessing the performance, and enhancing retention and transfer. These instructional events form the basis for the design of instruction as described by Gagné and Briggs (Gagné & Briggs, 1979).

The events of interactivity

Rose stated that "interactivity eludes clear definition; thus, those writings about it seem to find it easier to explain what interactive instruction is by contrasting it with what it is not as follows: not teacher-controlled but learner-controlled; not a lecture, in which the learner is a passive recipient of information, but an opportunity for students to engage in active, hands-on exploration, often via hypermedia technologies" (1999, p. 44). These are interactive events as opposed to non-interactive events. For defining interactive constructs, it is essential that these conceptualizations are examined as perceived by the education community, and compared to see if there are similarities between theory and practice. This discussion is derived the items from **46** to **55** in Table 1.



The labels under each bar denotes related items as follows: Definitions, items 1–9; Existence, 10–16; Existence 1, 10.1–6; Existence 2, 11.1–3; Existence 5, 14.1–3; Motivation: 17–19; Motivation 1, 20–33; Motivation 2, 34–36; Learning Theory, 37–45; Events, 46–55. Please note that the item numbers refer to Table 1.

Figure 1. Item clarity ratings of the experts participated in the content validity process

The content validity of the interactivity survey

Eight professors, who were the experts in the field, assisted with the content validity of the interactivity survey. Validity has been defined as referring to the appropriateness, correctness, meaningfulness, and usefulness of the

specific conclusions that researchers derive from their data (Fraenkel & Wallen, 2003, p. 150). Of the eight professors, one was in the Department of Educational Leadership and had experience teaching courses via the Internet, one was working in a private company for a while and was very well known in the literature with her interactivity research focusing on the terms' conceptualization, and six were at the Department of Educational Leadership and Learning Systems of a major university in the United States. Of the six professors, one was an expert in learning and instructional theories, one was proficient in assessment and distance education, one was a survey researcher and statistics lecturer, and three were experts in instructional systems design. The experts evaluated items clarity by the following scale:

1. The item is not clear.
2. The item is somewhat clear.
3. The item is clear.

Furthermore, in the web form, a text area was provided for the reviewers to give their comments or suggestions to improve the clarity of an item. The analysis of the reviewer evaluation provided the content-related evidence of validity, which assured that the content and format of the instrument were appropriate and comprehensive. The review process was completed in two phases. In phase one, four professors gave their feedback. The instrument was revised on the basis of the comments. In phase two, the other four professors reviewed the instrument. Figure 1 illustrates their clarity ratings. Please note that the ratings in Figure 1 were grouped by the item sections in the online survey forms.

The Pilot Study

The sample of the pilot procedure consisted of one professor from each university in the database, resulting in 262 faculty members. Of the 262 invitations, 59 faculty members responded to the IS online. Due to the space limitations and the technical significance of this paper, item-based descriptive statistics are not listed here. However, the data was appropriate to conduct the necessary parametric analysis. Table 2 depicts the factor loadings of the IS data. The convention of numbering items was not changed in the following analysis. Thus, the item numbers that were removed from survey.

*Table 2***.** Item-based factor loadings of the IS

Items	C1	C2	C3
Functional Definitions of Interactivity			
1. Interaction includes all manners of behaviour, in which individuals and groups act upon each other.	-.217	.813	N/A
2. Interactions are reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another.	.229	.717	N/A
3. Interactivity is a complex, dynamic coupling between two or more intelligent parties. The nature of interaction requires cooperation, coordination of activities, power exertions over each other, and a degree of negotiation.	.713	-.234	N/A
4. Interactivity describes a learning process in which the student and the system (i.e., computer) alternate in addressing each other. Typically, each is capable of selecting alternative actions based on the actions of the other.	.685	-.225	N/A
5. Interaction is typically thought of as sustained two-way communication among two or more persons for purposes of explaining and challenging perspectives.	.676	.156	N/A
6. Interactivity is the extent to which the communicator and the audience respond to, or are willing to facilitate, each other's communication needs.	.578	.430	N/A
Cronbach's alpha	.52	.58	N/A
Existence of interactivity in various instructional settings			
10.2. Professor lecturing and encouraging students to ask content-related questions: Students are able to state their opinions about the content.	.028	-.103	.918
10.3. Professor lecturing and giving some pauses for small group discussions: Students in small groups have discussions about the content being lectured and share their conclusions with others in class.	-.085	.014	.904
11.1. Use of computer programs (i.e., educational software) for teaching/learning.	-.156	.876	-.077

Items	C1	C2	C3
11.2. Use of the Internet for teaching/learning.	-.092	.840	-.234
14.1. By reading textbook.	.871	-.126	.097
14.2. By studying visual representations in the textbook such as charts, diagrams, and photographs.	.922	.071	-.063
14.3. By solving problems or doing concept maps while reading.	.874	.003	-.090
Cronbach's alpha	.87	.82	.79
Function of interactivity			
17. Interactivity is a strategy to increase learner's motivation.	.827	N/A	N/A
18. Interactivity is a strategy to increase learner's participation.	.868	N/A	N/A
Cronbach's alpha	.71	N/A	N/A
The attribute of interactivity as a function of motivation			
20. Captures students' attention by using unexpected approaches to teaching, such as personal experiences.	.320	.679	.016
22. Maintains students' attention by varying the instructional presentation.	.264	.731	.320
23. Emphasizes the utility of instruction by stating how instruction relates to personal goals.	.070	.551	.549
24. Emphasizes the utility of instruction by having the learners determine how instruction relates to personal goals.	.436	.065	.595
25. Motivates students by providing opportunities for personal achievement.	.582	.407	.342
26. Makes instruction relevant by building on learners' previous experiences.	.729	.340	.233
27. Creates a positive expectation for success by making clear the instructional objectives.	.495	.599	.334
29. Provides opportunities for students to successfully attain challenging goals.	.701	.071	.401
30. Provides learners with a reasonable degree of control over their own learning.	.811	.113	.085
31. Allows learners to use newly acquired skills by providing opportunities to solve "real-world" problems.	.293	.418	.465
32. Uses positive consequences such as verbal praise, real or symbolic rewards.	.082	.123	.753
33. Ensures equity by providing consistent standards for all learners' tasks and accomplishments.	.190	.121	. 731
Cronbach's alpha	.83	.76	.77
The attributes increasing interactivity			
34. Between teachers and students.	.938	N/A	N/A
35. Among students.	.915	N/A	N/A
36. Between students and content.	.680	N/A	N/A
Cronbach's alpha	.81	N/A	N/A
The attribute of interactivity as a function of Conditions of Learning (Gagné)			
37. Gaining attention.	.372	.592	N/A
38. Informing learners of the objective.	.583	.574	N/A
39. Stimulating recall of prior learning.	.900	-.007	N/A
40. Presenting the stimulus.	.760	.351	N/A
41. Providing learning guidance.	.634	.370	N/A
42. Eliciting performance.	.717	.208	N/A
43. Providing feedback.	.104	.789	N/A
44. Assessing performance.	.204	.847	N/A
45. Enhancing retention and transfer.	.595	.371	N/A
Cronbach's alpha	.85	.79	N/A
The events of interactivity			
48. A lecture in which the learner is a passive recipient of information.	.821	N/A	N/A
50. A lecture in which the student is a spectator.	.907	N/A	N/A
51. A lecture in which the student is a participant.	.663	N/A	N/A
54. A lecture in which the student absorbs material.	.829	N/A	N/A
Cronbach's alpha	.80	N/A	N/A

C1: Component1, C2: Component2, C3: Component3

Discussion and conclusion

Although all of the factor loadings are given in Table 2, due to their theoretical constructs an independent factor analysis was carried out for each section of the survey (i.e., the events of interactivity, the attribute of interactivity, etc.). Factor analysis was carried out using the principal component method to uncover underlying relationships among responses. To observe the maximum variances of the factors that contribute to the model, the varimax rotation was applied to every factor solution by setting the threshold of one for the eigenvalues of each item. Naturally, the rotated solutions were possible to obtain if there was more than one component in the associated factor solutions.

The result of the factor analysis on the six variables of Functional Definitions of Interactivity showed two discrete components. These components were attributable to two sources of variation, having 56.2% cumulative variance of the eigenvalues. Although interactivity and interaction were used interchangeably, the factor analysis indicated that the faculty members perceived both terms differently, revealing two factor components: Interaction (Component 1) and Interactivity (Component 2). The interaction component accounted for 31.1% of the total 56.2% variance.

The factor structure of the seven variables of Existence of Interactivity in Various Instructional Settings showed three discrete components, named: Textbook (Component 1, having 30.6% variance), Use of Computer (Component 2, having 24.3% variance), and Classroom (Component 3, having 22.2% variance). These components were attributable to three sources of variation, having 77.1% cumulative variance.

Function of Interactivity loaded only one factor component, having 65.2% variance.

The Attribute of Interactivity as a Function of Motivation consisted of 12 items. Factor analysis with varimax rotation revealed three discrete components: Attention-Relevance (Component 1, having 21.7% variance), Confidence (Component 2, having 19.5% variance), and Satisfaction (Component 3, having 18.4% variance). These components were attributable to three sources of variation, having 59.6% cumulative variance of the eigenvalues.

The Attributes Increasing Interactivity loaded only one factor component with 72.6% total variance.

The Attribute of Interactivity as a Function of Conditions of Learning consisted of nine items. Factor structure included two components: Guidance (Component 1, having 35.4% variance) and Communication and Assessment (Component 2, having 27.3% variance). The total variation turned out to be 62.8%.

Finally, the Events of Interactivity loaded only one factor component by a total of 65.6% variance.

This study developed a 49-item instrument, the IS, to evaluate the perceptions of faculty members at departments of education at universities around the world. The instrument was originally designed for online data collection with an adaptive feature. The evidence of the instrument's content validity and its reliability is based on the pilot study, depending on both qualitative and quantitative data.

Due to the nature of the pilot study, the data presented above is too limited to speculate the faculty members' perceptions about instructional interactivity, especially by taking a comparative analysis with respect to personal characteristics such as gender, age, department, etc. However, the data was good enough to judge the instrument's internal consistency from statistical point of view.

In conclusion, this study is a theoretical paper because it conceptually synthesizes the literature about instructional interactivity and a technical paper from an instrument-development point of view. By utilizing this instrument, deeper analyses with a large sample size are needed to uncover the common perceptions among faculty members in departments of education about the nature of instructional interactivity.

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