The Practice of Instructional Design: The Process and Its Application

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Abstract

There is nowadays a lot of interest in the field of Instructional Design. The focus is still on theories and methodology of Instructional System Design (ISD), which are the fundamentals of the field and are absolutely important for its application. However, most professionals are involved in the daily practice of instructional design (ID). The practice of instructional design has a slightly different approach, which tend not to follow strictly the linearity of many ID Models that have been created over the past thirty years. Success in applying the ID methodology lies on a systemic validation and revision of all phases performed along the process of developing instruction. Another element to be considered in the practice of ID, aiming effectiveness and high quality results, is the synergy of all components and the team, which will be acquired by fully knowledge of the process by all.

1. Introduction

The phases of a design process - analysis, design, development, implementation and evaluation - are often thought of as unique, stand-alone events. Daily practice of ID methodology on PGL modules and on self-instructed courses at FGV-EAESP has proved differently. The main purpose of successfully practicing ID is to integrate theories and methodology with practice in order to simplify the design tasks and to facilitate the relationship among procedures, team, and methodology used.

According to Dick and Carey [1] the instructional process has traditionally involved instructors, learners and textbooks. The content to be learned was contained in the text, and it was the instructor's responsibility to "teach" that content to the learners. Teaching could be interpreted as getting content from the text into the heads of learners in such a way that they could retrieve the information for a test. Now, when we think of effective learning, we place the student in the center of the process. The way of improving instruction is improving the instructor by using a systematic approach to develop instruction by having the student as the main character.

In addition to that, instructional designers, instructors or subject matter experts (SME's), teaching assistants (TA's) and project coordinator have to analyze and evaluate performance to effectively design and develop solutions in the process of ID that will, as a result, reduce the gaps between current and desired outcomes.

The present paper has the following purpose:

- To present an ID model pointed towards practice;
- To present effective aspects of the implementation of ID on PGL modules and self-instructed courses at FGV-EAESP;
- To offer some guidelines for the process of developing courses and modules based on an ID methodology

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2. Coscarelli's ID Model linearity and systemic looping

There are many ID models explained on books, many of them have their origin on the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. Most of them are linear, some follow a time-line graph format, which idealized the process, others also include a component of revision, which will happen in many steps of the process in a "one-way" format, and there are also those that are either too vague or too detailed to the point of being repetitive.

The model presented on this paper and applied at FGV-EAESP projects was developed by Dr. William Coscarelli, Professor of Curriculum and Instruction from Southern Illinois University at Carbondale. Professor Coscarelli uses the model on his "Systematic Approaches to Instruction" class [2]. The elaboration of each component of the model addresses solutions. They are useful guides to match project needs with learning environment features. A brief explanation will be elaborated below (Figure 1).

- **Needs Assessment:** it will be determined what need to be done. It is a process for determining goals, identifying discrepancies between goals and status quo and establishing priorities for action [3].
- **Goals:** it will be determined what the outcomes should be, basically the goals are general statements of intent.
- **Context Analysis:** the surroundings are identified. According to Coscarelli [2], the following questions should be answered:
    1. Will course be offered only to groups? How big? How are they distributed?
    2. What other resources are available: people, facilities, or support services?
    3. How frequently will the course be offered?
    4. How long can the course be?
    5. How can the knowledge skills and attitudes acquired be reinforced once the course is completed?
    6. What media support will be available?
- **Learner Analysis:** the learner's profile is defined. Coscarelli [2] suggests the following questions:
    1. What are the student's subject matter competencies?
        At what levels are the students' current knowledge and skills in the subject matter area?
        What background experiences do the students have I the subject matter area?
        Are the students likely to have any major misconceptions in the subject matter area?
    2. What are the students' attitudes?
        What are the general attitudes of the students toward the instructional content are there any subtopics within the content toward which students are likely to feel very positive or very negative?
    3. At what levels is the students' language?

        What is the language level of the students?
        What preferences for style of language (e.g. conversational or formal) do the students have?
    4. What tool skills do they possess?

Do the students have any sensory-perceptual deficiencies that will require special attention?

Can the students handle the instructional materials and equipment?

- **Hierarchical Task Analysis:** it will be identified what learners have to know to complete accomplish the task. The hierarchical approach is used to analyze goals that are classified as intellectual or psychomotor skills [1].
- **Objective:** the specific learning objectives are defined. The objective has the purpose of informing what the student will be able to do when finishing the task. The ABCD format developed by the University Consortium of Instructional Development and Technology [4] helps the designer to remember to include the main four elements: audience, behavior, conditions and degree.
    A. Who will do the task?
    B. What is the observable, measurable, and thus clearly defined performance?
    C. What level of learning, materials, instructions, environment, time, or other constraints will be imposed on the learner's performance?
    D. What is the standard of performance, e.g., quantity, accuracy, or reference?
- **Information Processing Analysis (IPA):** step in which the sequence of elementary operations used to solve any problem of a given task will be defined. The IPA has three components: operators, discriminators, syntactic structure [2]. IPA can reveal task-related content, objectives, or skills [5].
- **Learning Task Analysis:** learning tasks that can be described by two types, tasks that student must memorize or remember and tasks that are to be used or applied will be identified. Robert Gagné [6] classified the learning outcomes into five categories. We will focus on the two types of learning outcomes that are most common in our case, which will be briefly elaborated:
    1. Attitudes
    2. Verbal Information: simple associations between names, objects, symbols; declarative knowledge, facts, concepts, principles or procedures.
    3. Intellectual skills: procedural knowledge that requires prior learning of simpler component skills (discrimination, concrete concepts, defined concepts, rule, higher order rules – problem solving)
    4. Cognitive strategies
    5. Psychomotor skills
- **Delivery Strategy:** step in which the ways to carry information from a source to a receiver and vice-versa for the purpose of instruction will be defined. The strategies include print, audiovisual, computer-based, and integrated technologies.
- **Tactics:** instructional strategies are defined. They describe the general components of a set of instructional materials and the procedures that will be used with those materials to elicit particular learning outcomes from students. [1] The tactics include motivational strategies (suggestion: ARCS Model from [7]), information presentation (suggestion: Nine Events of Learning from [8]); sequencing that proceed in an order from simple to complex, concrete to abstract, know to unknown.
- **Criterion Referenced Test:** test items will be developed aiming appropriate testing strategies that will connect learning objectives with content learned. The criterion-referenced test will measure a person's competence against a given standard. The testing includes pre and post-tests [9].

- **Formative Evaluation:** information is gathered on the adequacy of the instructional program and then the information is used as a basis for further development and adjustments.
- **Analyze & Revise:** the most important procedure during the whole process of analysis, design, development and implementation. Revisions and new analysis are constant and do not follow revisions and new analyses are constant and do not follow any linearity during de process.

Although the model is characterized by a linear process, it also allows greater flexibility in the management and order of the design activities. The linearity is broken by two factors. First, the daily working process is performed by a team composed by members from a diverse educational background who have share rich working experience. In the initial meeting, an instructional designer, a SME's, a programmer, a web designer were present in order to analyze and discuss the project, the learner, the content, and the delivery strategies. The second and most important factor is the process and practice of constant revision and analysis. The design and the development started and during those concurrent phases the outcomes are validated and analyzed again. The model allows for a systemic looping for revision and analysis of all phases, because the phases are inter-related from the beginning through the end of the process by the arrows, which are represented in a "two-way" format. Moreover, the three first analyses (context, learner, and hierarchical) are not placed strictly in a linear format, they are also inter-connected and offer flexibility in terms of depth and time, to internal changes during the revisions.

3. The Differences between applied ID and ID theory

Instructional theory is composed by extensive and distinct facts and principles from different theories. According to Seels and Glasgow [3] there are three main instructional design paradigms: behaviorist, cognitivist, and constructivist. Each one has its own definition for learning, it has a different set of types of learning as well as instructional strategies, media strategies, and a key concept, which Seels and Glasgow [3] describe as reinforcement for behaviorism, elaboration for cognitivism, and finally autotelic principle for constructivism. One difference is that generally the design theory of instruction is based on only one paradigm. Although theories confirm and support that it is impossible to achieve standards of successful learning outcomes through predetermined objectives in a learning environment designed upon constructivist paradigm because the evidence of learning outcomes are often of a subjective nature, the practice of instructional design has shown that it is possible to design instruction based on the characteristics of all paradigms. As Seels and Richey [10] point out, "each paradigm seems to have an affinity for different types of learning and delivery systems. (…) Nevertheless, facts can be learned through cognitive science approaches, and problem-solving procedures can be learned through behaviorism". This assertion confirms that it is possible to develop instruction based on elements of different paradigms. The PGL modules and the self-instructed courses designed at FGV-EAESP, had the content elaborated and the activities developed based on a cognitivist-behaviorist approach.

Another difference between theory and practice is on the order of events. When analyzing and applying an instructional design method, the tendency is to follow each phase linearly as if there would have a beginning, a middle and an end of the process. According to Sara McNeil [11] "instructional design can start at any point in the design process. Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the

entire process is done the designer looks back and she or he checks to see that all parts of the "science" have been taken into account. Then the entire process is written up as if it occurred in a systematic fashion." Besides that, due to the process of constant validation and revision, a phase may be addressed later or ahead of others. Another aspect is constraints such as time, budget, and professionals that may be present at the beginning or appear during the project, which may influence in the implementation of all phases.

4. Components of an ID Model and its application on PGL modules

The process of module development of the PGL is divided in three main aspects that are interrelated in order to attend all the content development needs. The three aspects are instructional design, subject matter/content expertise, and production/technology. The PGL Model has four components, the component "evaluate" is surrounded by "analyze", "design", and "develop", which are connected by "two-way arrows" to indicate a systemic revision of the phases. Similarities are present in both models, mostly what concerns revision and evaluation. The training provided by the PGL program for the local school instructors involved in the project has been considered of great importance by the coordination of the program at FGV-EAESP. Due to the fact that every team member was already familiar with the methodology, the process of analysis worked smoothly. Each school sent to FGV-EAESP a proposal and from that point, a process of systemic validation and revision of the phases started to take place. The results of those revisions have shown that the outcomes were very positive. The schools have also evaluated students individually and have filmed students sitting in front of the computer learning the content developed by the PGL Program. There are two components of the Coscarelli [2] instructional design model that if applied to the PGL modules will be of relevant meaning in case of using the modules as learning objects. The components in fact belong to the classification of task analysis: information processing analysis and hierarchical task analysis". These two analyses are of extreme importance because they will be very effective to plan and organize the modules for a curriculum of intellectual skills, which (that is already the case of PGL) will be stored in data base.

5. Critical Factors of Success in the Practice of ID

Demystifying ID: it is of great relevance for the project to work that every single team member understands what instructional design is and identify his/her participation and the importance of his/her contribution in each one of the phases. The demystification starts by defining ID and explaining how it works. The definition has to be of easy understanding such as "instructional Design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning." [11]. In addition to the definition, a couple of keywords for discussion should be given: pedagogical planning (to attend the instructor's understanding needs), process analysis, development of content, activities and evaluation.

SME's Guide: the following instructions have been adapted from a guide that the instructional design team has developed for the instructors involved in the self-instructed course development from FGV-EAESP:

1) General Recommendations:
   - The self-instructed on-line course should have content with the following characteristics: detailed, objective, and content divided into "chunks". This

format has the purpose of facilitating student's understanding because no interaction between student and instructor will take place. Important: each concept or topic has to be followed by an example and reinforcement exercise.

- Writing objectives: a course should have two types of objectives – general and specific. The general objective or goal has the purpose of informing the learner of the overall course's intent. Example: "the course's objective is to expand participant's knowledge about the evolution of recent concepts about the creation and maintenance of brands and to describe the process of developing brands." Specific learning objectives, also known as final objectives, have the purpose of informing what the learner will be able to do after accomplishing the module. Example: "at the end of this module you will be able to define the concept of branding and identify the attributes of brand equity."
- Evaluation exercises: there are two types of exercises, the first is the reinforcement exercise and the second is the test item for the final evaluation. The reinforcement exercise comes right after the topic's explanation. The test items for the post-test (final evaluation) will be placed at the end of the module or course. Types of testing items: true/false items; matching items; multiple-choice items (with multiple answers or single answer); and fill in items.
- The format suggested is flexible. The ID team is available to answer questions and help during content development.

2) Course Presentation:
   - Write an introduction summarizing the main points of the course.
   - Write general learning objectives.

3) Course Content:
   - Divide content into 6, 9, or 12 modules e define a title for each module.

4) Modules
   - Divide modules into topics.
   - Write specific/final learning objectives for each module.
   - Write short and straight to the point paragraphs that will be followed by an example and illustration when applicable.
   - Include reference material: glossary, images, articles, complete bibliography, cases, examples, literary fragments, national and international websites (URLS).
   - Write reinforcement exercises (see guidelines above).
   - Write positive feedback for correct and incorrect answers.
   - Write a summary at the end of the module according to the final objectives.
   - Example of a simple flowchart to help content structuring (Figure 2).

Bloom Taxonomy: is being currently used at FGV-EAESP as a reference to write learning objectives. The Bloom Taxonomy, also known as the Taxonomy of Educational Objectives, is a classification system that classifies learning outcomes into three domains: cognitive, affective, and psychomotor. The cognitive domain presented here describes the thought processes that constitute various intellectual abilities [12]. The five classes of the Bloom Taxonomy are presented in a pyramid format in order to illustrate that to reach the top, skills from a lower level have to be accomplished first (Figure3).

The Classification Table has the purpose of allowing instructors and educators to communicate with more precision, goals and outcomes to their students. Moreover, it

allows instructors to write learning objectives that are more consistent with instructional goals, design learning activities, and develop evaluation items according to the objectives. The first column of the table illustrates each major classification and its subordinated skills. The second column shows the process to accomplish the skill and the third column possible outcomes as a result of the learning process (Table1).

Constant Validation: the process of validation and revision starts by building trust among instructional designer, SME (instructor) and TA. Sometimes SME's feel vulnerable because through the process of design his content and maybe his lack of full-understanding of the process will be exposed. An instructor when teaching a face-to-face class may use his body movement and spontaneous examples to explain a concept, which will not happen when he develops activities and explanations for a web-based instruction or self-instructed course. The channel of communication must be open and sincere in order to have a trusting relationship. After building trust, the validation will take place smoothly. It will happen during all the phases of the instructional design process.

6. Conclusion

The practice of instructional design in the PGL program and self-instructed courses has revealed the importance of a blended and flexible design. The ID model presented in this paper works as a reference and a guideline for the application of the ID methodology due to its two main characteristics: practice-oriented and its systemic loops for analysis and revision. Moreover, the successful outcomes are results of well-integrated team members working and valuing revisions in order to constantly improve all the phases that were accomplished along the process. Such intense validation was performed because team members have been well-oriented about the ID process through workshops, well-designed guidelines, reference material such as Bloom's Taxonomy, and by the use of ID models that are directed toward a systemic process of revision and analysis. Finally, courses and modules that have been developed through a systematic and systemic approach of instructional design have shown to be more effective, which for sure will be the bases for the design of content aiming to ensure the common standards of learning objects.

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Figure 1 - Coscarelli (1999). - Coscarelli's Instructional Design Model

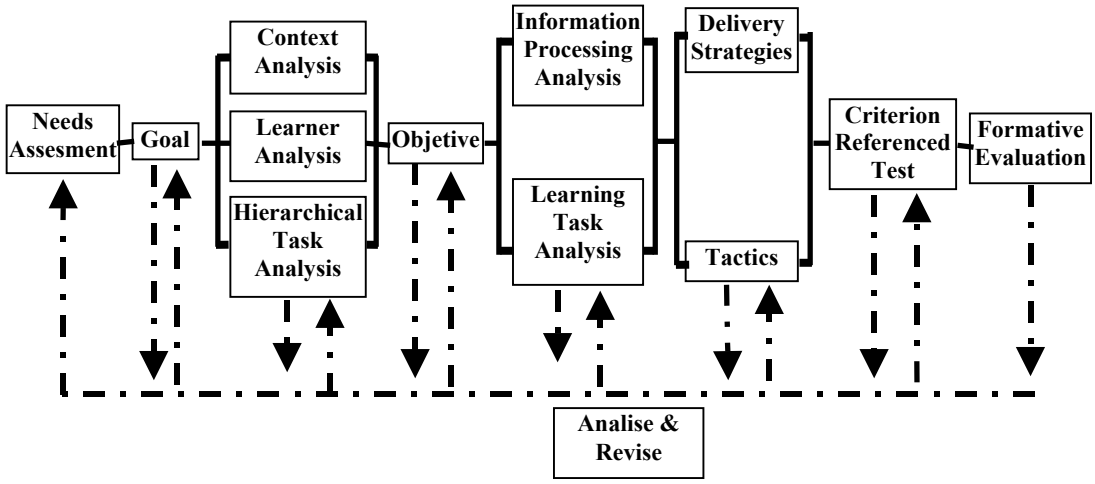

Figure 2 - Flowchart

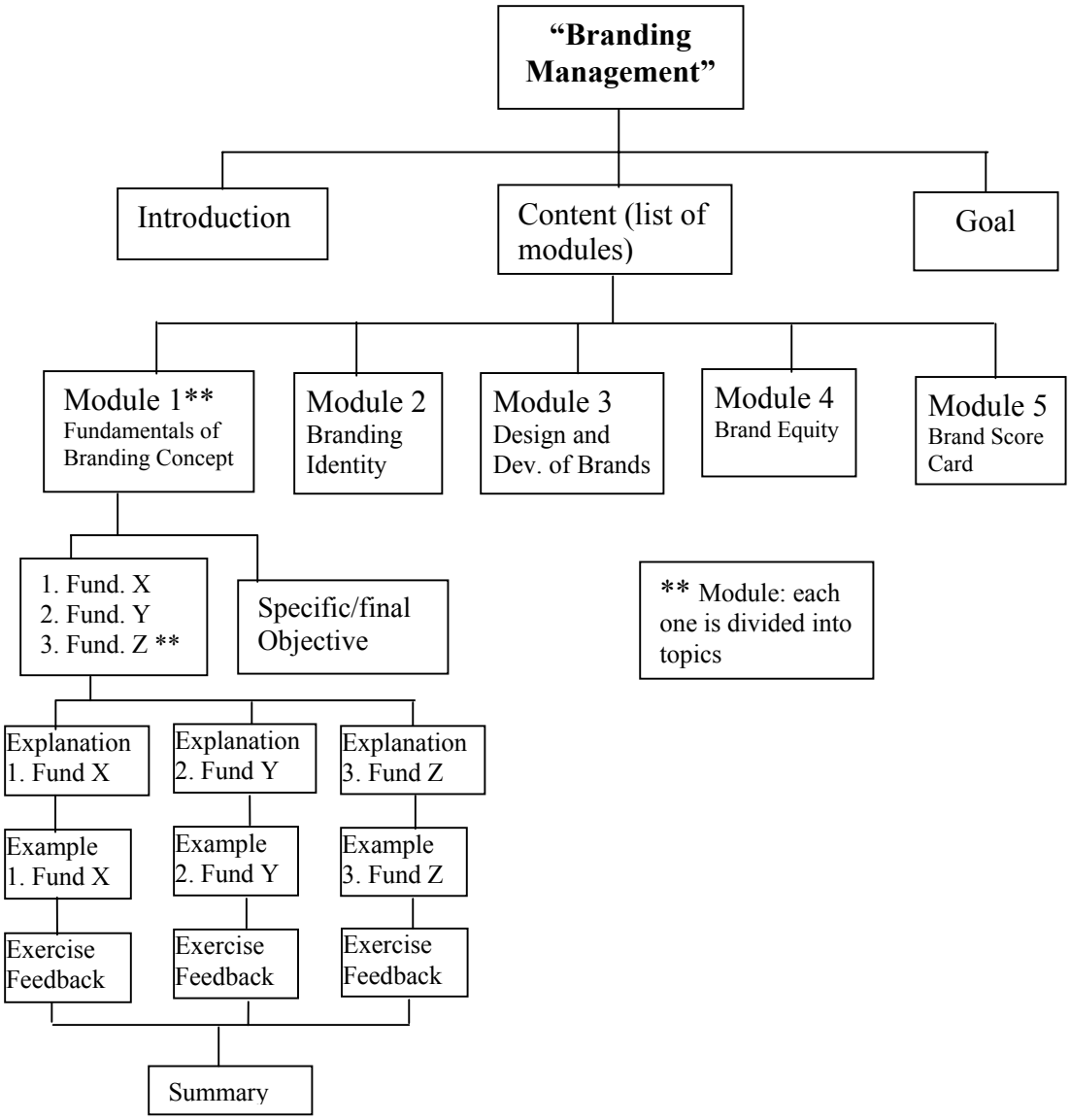

Figure 3

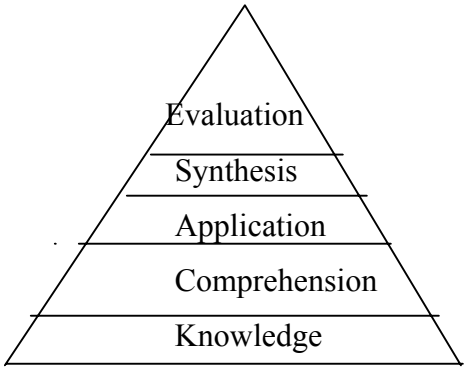

Table 1 – Classification Table, Adapted from Bloom(1956).

Classification	Process	Outcomes
Knowledge: memorize and recall facts, principles, terminology, etc. • Knowledge of facts and specific terminology. • Knowledge of trends and sequences. • Knowledge of classifications and categories. • Knowledge of criteria. • Knowledge of methodology. • Knowledge of the universals and abstractions in a field (principles, generalizations, theories, and structures).	to recognize to repeat to identify to label to name to order to collect to list to arrange to match to memorize	labels names facts definitions concepts
Comprehension: it implies elementary use of knowledge items such as: • Translation (paraphrase, retelling, language translation). • Interpretation (summarization). • Extrapolation (extending information for inferring or predicting)	to translate to interpret to explain to describe to report to tell to indicate to restate to review	translation argument explanation description story indication
Application: in order to apply knowledge, one must know it first (Level 1) and comprehend (level 2). • Abstraction of knowledge in form of rules and generalizations. • Application and use of abstractions in various concrete or abstract learning situations.	to apply to resolve to demonstrate to prepare to build to dramatize to make to illustrate to calculate to complete to practice to modify to change to classify to solve	diagram illustration collection map game or puzzle model report photography lesson

Table 1 – Classification Table, Adapted from Bloom(1956). (cont)

Classification	Process	Outcomes
Analysis: entails breaking a whole idea down into its component parts, analyzing the elements of an idea, the relationship between those elements or the organizational principles on which that idea is based , i.e., the structure of the idea. • Analysis of elements. • Analysis of relationships • Analysis of organizational principles	to analyze to connect to relate to distinguish to classify differentiate to structure to diagram to interpret to criticize to categorize to remove to compare to dissect to investigate to explain to select to test	diagram questionnaire category survey table delineation diagram conclusion list plain resume comparison problem solving(solution)
Synthesis: Knowledge that has been broken down into its component parts can be reassembled to form a new whole (if the ideas are reassembled to produce the same idea, it is only analysis behavior). A new operational plan or set of relationships derived from the old implies synthesis level performance. • Production of a unique communication. • Production of a plan or proposed set of operations. • Derivation of a set of abstract relations.	to project to construct to consolidate to aggregate to compose to formulate a hypothesis to arrange to imagine to invent to create to infer to produce to integrate to modify to substitute to plan to prepare to generalize to write	poem project project summary formula invention history solution machine movie program product

Table 1 – Classification Table, Adapted from Bloom(1956). (cont)

Classification	Process	Outcomes
Evaluation: it is the highest-level cognitive behavior and presupposes the completion of all lower-level tasks on a body of knowledge, that is, one cannot evaluate an idea unless one is able to comprehend, apply, analyze, and synthesize.that idea.. • Judgements in terms of internal evidence (logical accuracy and consistency) • Judgement in terms of external criteria (commonly accepted measures or references)	to appraise to argue to judge to criticize to select to decide to select to predict to evaluate to measure to discriminate to recommend to persuade to compare to rate to support to assess to estimate	opinion judgment recommendation verdict conclusion evaluation research editorial paper exam test interview