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Instructional Method Classifications Lack User Language and Orientation

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ABSTRACT

Following publications emphasizing the need of a taxonomy for instructional methods, this article presents a literature review on classifications for learning and teaching in order to identify possible classifications for instructional methods. Data was collected for 37 classifications capturing the origins, theoretical underpinnings, purposes and uses, as well as degrees of documentation of these classifications. Using cluster analysis, the classifications were first grouped into three clusters according to their characteristics. A discriminant analysis identified three foci: narrow focus, holistic focus and versatile focus. Second, classifications were estimated whether they fulfill taxonomy validation criteria, which are used to judge classifications' internal consistency, meaningfulness to users, ease of navigation, and comprehensible content division. Only a small number of the reviewed classifications fulfilled more than one of the criteria, with the most criteria fulfilled being three. The article concludes that a classification of instructional methods is still needed as the reviewed classifications do not provide sufficient quality, purpose-related setup, or user orientation. Future classification efforts should involve the users in the development to ensure appropriate language and task orientation of the classification. An approach for performing user-driven development is outlined, and applications in a higher education setting and instructional design software are demonstrated.

Keywords

Classification, Taxonomy, Education, Instructional Method, Teaching Method

Problem Definition

Instructional designers often rely on systematic processes when creating instruction. They might, for instance, use the Dick and Carey model of instructional design (Dick, Carey, & Carey, 2005). Decision instruments or models can help support the instructional design process. The cognitive learning objectives taxonomy by Bloom et al. (1956), revised by Anderson & Krathwohl (2001), is probably the most widely used support instrument. The taxonomy was originally used to classify student learning outcomes to promote the exchange of test questions (Shulman, 2007). Instructional designers use this taxonomy to classify and then align learning objectives with learning and assessment activities. Use of this systematic classification process ensures accuracy in the instructional approach (Anderson & Krathwohl, 2001).

Other steps in systematic instructional design could also benefit from a similarly useful instrument. An instrument aimed at supporting the selection of appropriate instructional methods would greatly benefit instructional designers. For the purposes of this article, *instructional method* is defined as a learning outcome oriented set of activities performed by learners and learning supporters. Examples of instructional methods are the think-pair-share method (Harvard Project Zero, 2008) or the brainstorming method.

In the light of technological advances, there is a rising call to better organize instructional methods for ease of access (e.g. Currier, Campbell, & Beetham, 2005; Koper & Olivier, 2004; Oliver, Harper, Wills, Agostinho, & Hedberg, 2007; Griffiths & Blat, 2005). Increasingly, instructors are sharing their instructional methods in digital form. Instructors want user-friendly, fast and efficient access to the rapidly growing number of shared instructional methods for teaching and learning stored in online repositories. A versatile and reliable instrument, which clearly arranges instructional methods for use in instructional design processes and for organization in online repositories, would help meet this rising demand.

The literature review presented in this article examines the effectiveness of existing classification systems for organizing and accessing instructional methods. The questions that built the foundation for this literature review are:
1. What classifications for learning and teaching and, particularly, for instructional methods already exist?
2. How and for what purposes were these classifications developed?
3. Do the identified classifications fulfill key criteria for quality and do they resolve the supposed problem of a need for a versatile and reliable instrument to classify and organize instructional methods?

This literature review comprises two parts. First, the reviewed classifications were organized into categories. Second, the classifications were evaluated for quality and judged for their ability to solve the stated problem.

Analysis Part I: Organizing the Literature

The literature review identified 37 classifications. The starting point for the literature review was a thorough search of the Joint Information Systems Committee (JISC) reports. JISC has funded several research initiatives with the goal to unify pedagogical vocabularies and taxonomies (e.g. Currier, Campbell, & Beetham, 2005; Mayes & de Freitas, 2005; Conole, Littlejohn, Falconer, & Jeffery, 2005). The literature review includes nearly all references cited in the JISC reports relating to classification. We then searched for additional English literature in the JSTOR, Education Resources Information Center, and google scholar databases. Keywords used during the search were classif*, taxonom*, group*, categor*, system*, learn*, teach*, instruct*, didactic*, pedagog*, educat*, model*, scenario*, and method*. To offer a perspective outside English literature, we included German references as there is a long tradition of systematizing instructional knowledge in this culture. We incorporated frequently referenced books and book chapters from German literature from the past 30 years to represent major achievements. Articles from French backgrounds that were written in English were included via the regular search routine in databases. Last but not least, we included organizational schemas of online repositories, predominantly from the Gateway to Educational Materials (GEM Consortium, 2008), DialogPlus (2006), the Scottish electronic Staff Development Library (Currier, 2001), and the Reusable Educational Software Library (RESL, 2008) to represent the technological perspective of organizing instruction-relevant materials.

The representativeness of the chosen sample references is hard to estimate. The characteristics of the overall population are unknown. We assume for this study that the sample references are signature examples of the field because all references are cited frequently within the community. For instance, a search of google scholar on June 29, 2009 showed that Farnham-Diggory's framework (1994) was cited 65 times, Flechsig (1983) was cited 13 times for the original 1983 instructional model publication and 94 times for the revised 1996 handbook publication (Flechsig, 1996). Anderson & Krathwohl (2001) were cited 955 times.

The data collection system of Andrews & Goodson (1980), which compared 40 instructional design models, was used to examine the classifications. Data collection included the origin, theoretical underpinnings, purpose and use, and degree of documentation. A table containing descriptions of all 37 classifications is available on the World Wide Web at http://www.heyerlevel.de/calimero/tools/proxy.php?id=12873.

Most references did not include information regarding the development of the classifications. Usually, the end result – the classification – was presented and described. Analysis revealed that most of the classifications were based on author's opinion, resulting in an unverified assembly of dimensions and scales. Authors seldom used empirical studies, analyses, or theoretical backgrounds to construct or validate classifications. Examples that did include such measures are Fuhrmann & Weck (1976), Brown, Bakhtar, & Youngman (1984), Kyllonen & Shute (1988), and Anderson & Krathwohl (2001). Only a handful of the reviewed classifications are being used in practice, among them Felder & Silverman's learning and teaching styles (1988), Bloom's learning objectives taxonomy (1956), and repository classifications like GEM (2008) and RESL (2008).

Authors identified specific purposes for their classifications, but rarely did an author take preceding classifications into account. Similarly, Andrews & Goodson (1980) stated in their comparative analysis of instructional design models that, "since many models are never tried out, educators may be skeptical about the model being reviewed and thus decided to develop their own" (p. 177). An exception to this is Bloom's original taxonomy of 1956, which has been reused for differing purposes across the globe (Anderson & Krathwohl, 2001).

Three Step Procedure

The first part of the analysis organizes the classifications. We applied the following three-step procedure to achieve this goal:

1. Creating categories.
2. Rating each classification within each of the categories.

3. Determining the reliability of ratings, performing cluster analysis to group the classifications and discriminant analysis to identify discriminating characteristics.

The first step resulted in the creation of ten categories used to organize the classifications. A phenomenological approach was used to establish the categories. Authors of classifications often describe their intent and the entity of interest to be classified in their publications. Using this information, commonalities in the target entities of all classifications were identified. The commonalities were then characterized to create a manageable number of categories. For example, Brown et al. (1984) addressed lecturing styles in their classification. They focused on the instructors' actions in a specific setting – the lecture. This classification helped to establish the category "teaching activity". It is expected that other instructional experts will agree with the ten categories because the categories resemble common and readily recognizable concepts in instructional design. The ten categories used in this literature review are listed in Table 1.

Table 1: Categories to differentiate foci of classifications

Category	Description of category	Example
Educational theories/strategies	General strategies derived from empirical findings or educational/instructional theory; these do not include precise steps to set up a learning situation.	From Carey, Swallow, Oldfield (2002): anchor new knowledge in authentic contexts, apply theory in practice
Instructional methods	Set of actions performed by the participating learners and learning supporters that arranges a learning situation towards learning outcomes.	From Currier (2001): discussion, peer teaching, lecture
Teaching activities/Lecturing styles	Actions performed by the instructor; the focus is solely on instructor actions.	From Saroyan & Snell (1997): [give] introduction, [integrate] periodic summaries, signposts, transition cues
Learning activities/processes/ tasks/styles	Actions performed by the learner; the focus is solely on learner actions.	From Merrill et al. (1992): identify, execute, interpret, judge, classify
Assessment methods	Methods used to evaluate the outcomes of learning.	From GEM (2008): peer evaluation, portfolio, self-assessment
Learning objectives/goals	Learning outcomes stated as a (cognitive) process to be carried out in relation to a type of knowledge.	From Anderson & Krathwohl (2001): remember factual knowledge, apply procedural knowledge
Type of (subject) matter	Differentiation of particular types of (subject) matter or subject-specific knowledge.	From Reigeluth & Moore (1999): topic focus, problem focus, interdisciplinary focus, domain focus
Learning materials	The types of information-carrying resources used in learning.	From RESL (2008): animation, dataset, image, sound, text, video
Media	Technology and other tools that support or enable learning processes.	From Conole (2007) citing Laurillard: Assimilative, information handling, adaptive, communicative, productive
Other	Used for items that did not fit any of the other categories, or if the classification was a theoretical construct not intended for practical application.	From OECD (1999): primary level, lower secondary, upper secondary, first stage tertiary education

During the second step, one of the authors of this article rated the 37 classifications to determine the intensity with which each classification focused on the ten categories.

A metric scale ranging from 1 to 7 was used for the ratings, where 1 meant *not a focus*, 3 meant *weak focus*, 5 meant *intermediate or shared focus*, and 7 meant *strong or predominant focus*. The same classification could receive high ratings for several categories. For instance, the thinking routines by the Harvard Project Zero (2008) received an average rating of 7 for the category instructional methods, and an average rating of 1 for the rest of the categories. Another example is Kyllonen & Shute's (1988) taxonomy of learning skills, which comprises four dimensions (instructional environment, resulting knowledge type, domain, and learning style). This taxonomy first received a rating for the overall goal of the entire taxonomy (namely, learning skill classification) and second, received ratings for each of its dimensions. This two-tiered rating resulted in high scores (between 5 and 7) for the categories educational theories/strategies, learning activities, and type of (subject) matter, and resulted in low scores for the remaining seven categories.

In order to heighten the reliability and consistency of the assigned ratings, the same individual performed three rating rounds over a time span of two weeks. In an effort to eliminate influences caused by cognitive activation and prompting, the order of assigning ratings to classifications varied from round to round.

The third step included a statistical analysis to determine the reliability of the assigned ratings and to group the classifications. The reliability of the ratings was determined using two-tailed Pearson correlations for the first and second rating, the second and third rating as well as for the first and third rating. This generated 30 correlations, of which 29 were significant at the 0.01 significance level after Alpha-Adjustment according to Bonferroni-Holm, and one correlation was significant at the 0.05 level. Since all correlations may be considered significant, the ratings can be regarded as reliable, and averages for the ratings may be used in further calculations.

In order to identify groups of classifications by means of cluster analysis, an average rating was calculated for each category and each classification. A weighted average was used to give more weight to the second and third ratings. The first rating equaled 20% of the overall weight, while the second and third ratings each made up 40%. A cluster and a discriminant analysis were conducted using the weighted averages. The goal of the cluster analysis was to identify groups with similar ratings on the categories. The role of discriminant analysis was to achieve maximum distinction between the groups with a minimum number of discriminant functions.

Results of Analysis Part I

To find groups of classifications, a hierarchical cluster analysis using Ward's (1963) linkage method and squared Euclidean distance was applied as a measure of similarity. The visualization of the clustering process in the dendrogram indicated two possible solutions, namely three or six groups of classifications. Further analysis of these solutions indicated a preference for the three cluster result.

A stepwise discriminant analysis was performed to identify differences between these groups or clusters. The analysis showed that two discriminant functions (eigenvalues 7.37 and 1.70, explaining 81% and 19%) can satisfactorily distinguish between the three groups of classifications (correct classification: 93%). Of the original ten categories (cp. Table 1), only seven are relevant for structuring the groups (this was shown for the three clusters as well as for the six clusters result). *Assessment methods*, *type of (subject) matter* and *learning material* are irrelevant categories for grouping the classifications. Using the other seven categories, which may be called grouping-relevant categories, three meaningful groups emerged. Table 2 shows the groups and the corresponding classifications.

Table 2: Classifications and their assignment to the three groups obtained in the cluster analysis
(Order reflects similarity: the closer the classifications are to one another within a subgroup, the more similar they are.)

Group I: Narrow focus	Group II: Holistic focus	Group III: Versatile focus
Subgroup: Learners in Learning Situation	**Subgroup: Instructional Methods**	Taxonomy of Scottish electronic Staff Development Library (SeSDL) (Currier, 2001)
Classes of Instructional Transactions (Merrill, Jones, & Li, 1992)	Taxonomy of scenarios and scenario-based engineering (Lejeune & Pernin, 2005)	
Framework for Learning Design Typology (Oliver, Harper, Wills, Agostinho, & Hedberg, 2007)	Thinking Routines (Harvard Project Zero, 2008)	Reusable Electronic Software Library (RESL, 2008)
Levels of Teaching (Hokanson & Hooper, 2004)	Goettingen Catalog of Didactic Models (Flechsig, 1983)	Dimensions of e-learning (Minass, 2002)
Classification of Individual	Seven Models for Teaching in	Framework for Comparing

Differences in Learning (Jensen, 1967)	Higher Education (Sader, Clemens-Lodde, Keil-Specht, & Weingarten, 1971)	Instructional Strategies (Reigeluth & Moore, 1999)
Taxonomy of Learning Skills (Kyllonen & Shute, 1988)	Classification System for Instructional Methods (Fuhrmann & Weck, 1976)	Taxonomy of Learning Activities (Conole, 2007)
Taxonomy for Learning, Teaching and Assessing (Anderson & Krathwohl, 2001)	GEM (pedagogic) vocabularies (GEM Consortium, 2008)	DialogPlus (DialogPlus, 2006; essentially belongs to Conole, 2007)
Subgroup: Teachers and their Actions	**Subgroup: Educational Theories and Strategies**	
	Notions of Learning (Martínez, Sauleda, & Huber, 2001)	
Lecturing Styles (Brown, Bakhtar, & Youngman, 1984)	Pedagogical Dimensions of Computer-Based Education (Reeves, 1997)	
Framework for Describing Characteristics of Lectures (Saroyan & Snell, 1997)	Educational Rationale Metadata for Learning Objects (Carey, Swallow, & Oldfield, 2002)	
Theories of Teaching (Ramsden, 1992)	Paradigms of Knowledge and Instruction (Farnham-Diggory, 1994)	
Learning and Teaching Styles in Engineering Education (Felder & Silverman, 1988)	**Subgroup: Outliers**	
	Methodology of web-based teaching and learning processes (Bloh, 2005)	
8 Learning Events Model (Leclercq & Poumay, 2005)	Classification of Educational Programmes (OECD, 1999)	
Basic forms of teaching and instructional events (Aebli, 1991)	Scenarios of Virtual Learning (Schulmeister, 2002)	
Heuristic Teaching and Learning Model (Baumgartner, 2001)	Thesaurus of ERIC descriptors (Houston, 1995)	
Elements of Education (Niemeyer, 1882)	Structuring Moments of Instructional Methods (Roth & Roth, 1978)	
	Framework for Teaching (Squires, 2004)	
	Classification of methods in computer-assisted instruction (Bodendorf, 1990)	

Group I is titled *narrow focus* because the group contained classifications concentrating on isolated components of a learning situation such as cognitive processes in learners, or actions performed by instructors. Classifications in group I received high ratings for three categories: teaching activities, learning activities and learning objectives. They received low ratings for the categories educational theory/strategy, instructional methods, media, and other.

Group II is titled *holistic focus*. The group contained classifications that have an integrative perspective on the learning situation, either focusing on the theoretical principles behind the learning situation or the overarching instructional methods. Classifications in group II received medium ratings for the categories educational theory/strategy, instructional methods, media and other, while receiving low ratings for the categories teaching activities, learning activities, and learning objectives. GEM (2008) may be regarded as misclassified in group II. While GEM endorses numerous vocabularies, only those relevant to instructional methods and assessment methods were included in this literature review. The assumption is that if all vocabularies had been included, GEM would have been part of group III. The last subgroup of group II could be excluded as it contains outliers. These classifications either scored high on the category other (like OECD (1999), which classifies educational programs at institutions), or had a rating pattern that no other classification did (e.g. Bodendorf (1990), which classifies media only).

Group III is titled *versatile focus.* The classifications cover a wide spectrum with no favorable focus on any of the categories. Classifications in group III received high ratings for all grouping-relevant categories. Many of the group III classifications are used within online repositories, especially SeSDL (Currier, 2001), RESL (2008), and DialogPlus (Conole, 2007). We assume that repositories aim for maximum access to their contents and therefore offer manifold browse criteria.

The advantage of having these defined groups is that they can be used to reliably rate and categorize other classifications, which were not part of this literature review. An extension or refinement of these groups is likely as the number of included classifications grows. The established groups reflect the categories initially created. The authors are aware that a different set of categories may have produced different groups and altered assignment of classifications to the groups.

Cross-Validation of Groups

To find out how stable the groups depicted in Table 2 are, a cross-validation was performed using the jackknife method. This method determines with what certainty new classifications could be assigned to the three groups. For group I, a (new) classification could be classified correctly into this group with 93% certainty using a Bayesian method, and with 79% certainty using the jackknife method. For group II, classifications could be grouped with 100%, respectively 88% certainty. Group III classifications could be assigned with 100% certainty for both methods. As a result of the cross-validation, the three groups are considered to be stable.

Analysis Part II: Evaluating Classifications against Taxonomy Validation Criteria

Effective taxonomies can be validated using a set of criteria that ensure the taxonomy's internal consistency, meaningfulness to users, ease of navigation, and comprehensible content division (Lambe, 2007). A classification of instructional methods, in order to be effective and applicable, must strive to fulfill these criteria. In the second part of the analysis, we used criteria for validating taxonomies (Lambe, 2007) to gauge the quality of the classifications. The criteria and their definitions are listed in Table 3. We chose these criteria because they originated in library science, a science with a long tradition in developing and applying classifications. Lambe and his team have reworked the original criteria by Kwasnik (1999) based on their experience in numerous taxonomy development projects (P. Lambe, personal communication, August 27, 2008). When reworking the criteria, they placed specific focus on user-friendliness and improving workers' tasks within organizations. This focus aligns nicely with our goal to identify a classification of instructional methods, which instructors apply in their instructional design tasks.

The second part of the analysis evaluates the classifications regarding the third question posed in the beginning of this article. The goal is to determine the classifications' quality and to judge whether existing classifications could solve the reported problem of a missing classification for instructional methods.

Table 3: Key criteria for taxonomy validation (Lambe, 2007, pp. 199f)

Criterion	Definition
Intuitive (is easy to navigate and use)	Users successfully predict in which category they are likely to find the content they want, just by looking at the top level. The taxonomy's structure reflects natural working or usage habits, assumptions or well-known structures.
Unambiguous (does not offer alternates)	Users do not have more than one obvious option for where to place content or find content they need. Users encounter a minimum of difficult choices as to

	where to place content or find content they need.
Hospitable (can accommodate all content)	The taxonomy successfully accommodates probable or foreseen new content, without the need for significant expansion or restructuring.
Consistent & predictable (provides context)	Consistency in how sub-categories are organized enables users to navigate the taxonomy structure successfully and quickly (complements *intuitiveness*).
Relevant (reflects user perspectives)	The taxonomy reflects common ways of organizing information and knowledge in the host organization (complements *intuitiveness*).
Parsimonious (no redundancy/repetition)	The taxonomy structure offers no more and no less than what is required for the content that is to be accommodated (is in tension with *hospitality*).
Meaningful (provides context)	Categories, sub-categories and topic terms enable users to successfully predict the kind of content to be found behind them. The terms used in the taxonomy reflect common usage (complements *intuitiveness*).
Durable (will not need frequent change)	The taxonomy does not need frequent change or expansion and rarely requires radical change or reorganization. A robust taxonomy generally requires a small audit of effectiveness every year unless there are radical and unexpected changes in the nature of content.
Balanced (even levels of detail/depth)	When the taxonomy is populated with content, there are relatively even quantities of content across the taxonomy categories, and relatively even numbers of topic areas per category across the taxonomy. Each level of the taxonomy has broadly consistent degrees of generality and specificity when compared horizontally across the taxonomy.

Method

Taxonomy validation is usually performed with an adequate number of actual users (Lambe, 2007). It was impossible to have actual users validate all 37 classifications included in this literature review. Also, the references for the classifications seldom provided information on user tests and quality-related judgments. Therefore, the most reasonable option was to estimate a validation. One of the authors of this article estimated how well each classification fulfills the criteria described in Table 3. The criterion *durable* was omitted from this process, as an estimation of this criterion was hardly justifiable. The purpose of this literature review is to identify useful instructional method classifications. Therefore, classifications were only judged in the context of organizing instructional methods.

This validation is limited because it omits actual user tests, and because the applied criteria are at times in tension to one another. Focusing just on the purpose of classifying instructional methods imposes another limit. If different validation criteria and a different purpose had been chosen, the evaluation result might look different. The estimations obtained using this method can nevertheless serve to determine where to commence more extensive evaluations.

Results of Analysis Part II and Discussion

Of the 37 classifications, 21 did not fulfill any of the taxonomy validation criteria. 10 classifications fulfilled one criterion only. These 31 classifications are excluded from the following detailed discussion as they do not exhibit minimal classification quality.

The remaining six classifications are part of groups I and II (cp. Table 2). Group III did not contain any classification that fulfilled the validation criteria. This may occur because the goal of the group III classifications is to provide access to an item in an online repository using various descriptors. Group III classifications may be less suitable for specific instructional design tasks, such as choosing technologies and adequate methods for specific learning settings.

The remaining six classifications, listed below, fulfilled two or three of the taxonomy validation criteria. For more details regarding these and the other classifications see the table at http://www.heyerlevel.de/calimero/tools/proxy.php?id=12873.

Leclerq & Poumay's (2005) *8 Learning Events Model* includes a list of eight activity types that learners perform during learning as well as eight matching actions that the teacher or mentor correspondingly does. The classification aims to reduce complexity of methods without slipping into simplicity and aims to foster pedagogical variety.

Felder & Silverman's (1988) *learning and teaching styles* feature four dimensions of learning styles and matching teaching styles. The purpose of development was to identify mismatches between learning and teaching styles in engineering education.

Saroyan & Snell's (1997) *characteristics of lectures* specifies three types of lectures: content-driven, context-driven, and pedagogy-driven. Their goal was to extend Brown et al.'s (1984) typology of lecturing styles to provide more detail on the lecture, the most widely used instructional method.

Anderson & Krathwohl's (2001) *educational objectives taxonomy* is a two-dimensional matrix of six types of cognitive processes (remember, understand, apply, analyze, evaluate, create) matched to four types of knowledge (factual, conceptual, procedural, metacognitive). The matrix was developed to help educators clarify what they intend students to learn.

Flechsig's (1983) *catalog of instructional models* provides twenty instructional models such as learning dialog, learning network, future workshop, and conference, that are used for planning teaching situations. Flechsig's goal was to reduce the complexity of instruction and to build a bridge between theory and practice.

Sader et al. (1971) specified seven course types in higher education, for instance, beginner exercise, research seminar and self-regulated learning network. The course types aim to vary the instructional methods applied in higher education.

Table 4 lists these six remaining classifications, their group assignment and the taxonomy validation criteria that each classification fulfilled.

Table 4: Fulfillment of criteria for remaining classifications

Group	Classification	Fulfilled criteria
Narrow	Leclerq & Poumay (2005)	Intuitive, consistent/predictable
Narrow	Felder & Silverman (1988)	Intuitive, consistent/predictable
Narrow	Saroyan & Snell (1997)	Intuitive, consistent/predictable
Narrow	Anderson & Krathwohl (2001)	Intuitive, consistent/predictable
Holistic	Flechsig (1983)	Intuitive, relevant, meaningful
Holistic	Sader et al. (1971)	Intuitive, relevant, meaningful

Discussion of Remaining Classifications of the Narrow Focus Group

Leclerq & Poumay (2005), Felder & Silverman (1988), Saroyan & Snell (1997), and Anderson & Krathwohl (2001) each fulfilled the two criteria *intuitive* and *consistent/predictable*. These classifications focus on relatively small, tangible entities such as learner or instructor actions. Classification users may *intuitively* access these classifications because actions of learners and instructors are easily visible.

The four classifications fulfilled the criterion *consistent/predictable* because their subcategories are organized in logical, comprehensible structures. They offer uncomplicated structures with small numbers of entry points at the top level and a small number of subcategories. This consistency may support the classifications' application. For instance, Felder & Silverman (1988) as well as Anderson & Krathwohl (2001) have had extensive documentation of usage after their introduction.

Discussion of Remaining Classifications of the Holistic Focus Group

Flechsig (1983) and Sader et al. (1971), the two remaining classifications of group II, provided lists of instructional methods. According to Lambe (2007), lists may be considered taxonomies since the inclusion of an item in a list shows that the item has relations with the other items on the list. Furthermore, lists are used to build more complex taxonomies (Lambe, 2007).

Flechsig's (1983) and Sader et al.'s (1971) classifications each fulfilled three criteria. These classifications are *intuitive* because classification users are to a great extent familiar with the titles of the instructional methods. The classifications are accessible at the top level. There is no layer above the actual list of instructional methods, allowing quick comprehension. This is contrary to, for example, Conole (2007), who includes instructional methods in her classification. However, she places several categories above the instructional methods. These additional levels are Context –> Task taxonomy –> Technique (How) –> Communicative. Only on the fifth level down is the list of instructional methods accessible. Even though this portion of Conole's classification highly relates to the two remaining classifications, the access to instructional methods in Conole's classification is too difficult since the top layers conceal the actual methods. Conole's classification was evaluated as not fulfilling the criterion *intuitive*.

Flechsig's (1983) and Sader et al.'s (1971) classifications are *relevant* because they commonly reflect how instructional methods are organized to this day – instructional methods are usually presented in a list (cp. GEM (2008) and ERIC descriptors (Houston, 1995)). These lists quickly get lengthy, thus, restructuring becomes necessary. The fulfillment of the criterion *relevant* may be challenged in future evaluations as instructional method classification advances.

Flechsig's (1983) and Sader's (1971) classifications are *meaningful* because users may successfully predict the kind of content to be found behind the categories, i.e. behind the list items. These lists perform well on the criterion *meaningful* because the classifications lack subcategories.

Flechsig's (1983) and Sader et al.'s (1971) lists did not fulfill the criterion *consistent/predictable* because the granularity of the included instructional methods varies considerably. For instance, in Flechsig's (1983) list, *distance learning* is named as an instructional model, and at the same level of organization the *learning dialog* is listed. Some users may argue that learning dialog is a much smaller instructional method than distance learning. Distance learning could in fact include several of the other models on Flechsig's list. Classification users cannot predict that the list includes instructional methods of great variance regarding granularity.

Criteria that None of the Classifications Fulfilled

None of the classifications in this literature review, not even the remaining six, fulfilled the criteria unambiguous, hospitable, parsimonious, and balanced. Why do classifications fail to fulfill these criteria?

Some classifications might have fulfilled the criterion *unambiguous* if they had been measured against their original development purpose, e.g. if Anderson & Krathwohl (2001) had been evaluated for the placement of educational objectives instead of classifying instructional methods. Anderson & Krathwohl's taxonomy (2001) does not fulfill the criterion *unambiguous* as an instructional method may cover several educational objectives that aim at different taxonomy cells. Placement of an instructional method into this taxonomy is thus ambiguous.

For the criterion *hospitable*, we assume that the variety of available instructional methods has not been captured in any of the classifications that were part of this literature review. Further, large bodies of undifferentiated content cannot be part of a *hospitable* classification. Lists do not fulfill the criterion *hospitable* because lists often accumulate large bodies of undifferentiated content.

None of the reviewed classifications accommodates the criterion *parsimonious* due to two reasons. First, hardly any classification arranges actual instructional methods. Second, none of the classifications have performed user tests to demonstrate that the classification accommodates no more and no less than necessary. This suggests that instructional method classification is in the beginning stages.

It is difficult to judge the criterion *balanced* as most classifications did not assign actual instructional methods. Most of the classifications examined in this literature review cannot accommodate instructional methods because they focus on learning setting components other than instructional methods. If instructional methods cannot even be accommodated, a *balanced* distribution is improbable. Lists, which do collect instructional methods, cannot be considered *balanced*.

Conclusion and Implications for Future Developments

Our analysis demonstrated that of the reviewed classifications, none could fulfill even half of the criteria for taxonomy validation when judged for the purpose of instructional method classification. The inability of the reviewed classifications to meet key criteria such as unambiguous, hospitable, parsimonious, and balanced suggests that developments for a classification of instructional methods are in the beginning stages. Furthermore, the preferred organization of instructional methods in lists indicates the need to move to more sophisticated structuring. The conclusion is that the statements about the lack of (or better, the need for) a classification of instructional methods are correct.

Future developments must take into account classification users' experiences and work processes to ensure that the classification reflects their perspectives and their ways of working with the pertinent information. The language used in a designate classification is most important. According to the validation criteria, the language must be intuitive so that users may quickly comprehend and access the levels of organization within the classification. The best way to ensure user-oriented language is to involve the eventual users of the classification in the development from the start. Lambe (2007) has outlined a process for approaching a user-driven classification development. The main stakeholders identify and repeatedly refine the future classification's purpose and scope together with a taxonomist. Then, the taxonomist sets up an approach for designing the classification. This approach is communicated to all stakeholders, then discussed and agreed upon among stakeholders. During the actual development, the taxonomist collects vocabularies and organizing principles from the stakeholders according to stakeholders' key tasks. The vocabularies are combined in a facet analysis and repeatedly adjusted to the work processes of the stakeholders. To ensure adequate quality of the classification, the taxonomist tests the classification using the criteria described in Table 3. This approach helped an instructional design department within an organization to create a classification, which helps to identify previously created learning materials for reuse in new instructional settings (Lambe, 2007).

A new classification of instructional methods could be developed, for example, with stakeholders at universities dealing with instructional methods. Two possible stakeholders include curriculum development teams and new instructors. Curriculum development teams have an interest in identifying instructional methods that former curriculum development teams have assigned to modules and learning outcomes. New instructors could benefit from having access to instructional concepts that former instructors have used to teach the same course or having access to guidelines on how to select methods when designing instruction from scratch. New instructors would be able to easily access the range of previous instructional methods including face-to-face, technology-enhanced and online methods. In both cases, the university could host a central repository, where instructional methods are organized and made accessible.

Finally, instructional design software that support the creation of units of learning such as the COLLAGE editor (Hernández-Leo, Villasclaras-Fernández, Asensio-Pérez, Dimitriadis, Jorrín-Abellán, Ruiz-Requies, & Rubia-Avi, 2006) or the Graphical Learning Modeller (Neumann & Oberhuemer, 2008) could benefit from an instructional method classification. These tools feature libraries of instructional methods, which could be sorted according to the classification. The classification would support users in choosing appropriate methods to integrate in their unit of learning.

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