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A Transdisciplinary Approach to Differentiated Instruction[1]

Russell Jay Hendel
Department of Mathematics, 8000 York Road
Towson Maryland, 21252
RHendel@Towson.Edu

ABSTRACT

Differentiated instruction (DI) improves student performance and student satisfaction especially when preliminary instructor training is provided. However, the DI literature is overwhelming, excessively challenging many instructors to create a DI for multiple learning styles. This paper employs a transdisciplinary approach to address this gap between theory and challenging operational implementation. #1) The discipline of architecture introduced the approach of universal design, advocating that new buildings be initially built to allow universal access; this contrasts with the prior method of attempting to comply with regulations after building completion, which is often costly and wasteful. #2) The discipline of neuro-psychology identifies higher cognitive brain function with (performance) executive function which in turn is simply implemented using a multiple-modality approach. This suggests that pedagogic emphasis should be given to initial universal instruction addressing several modalities in contrast to one current DI approach requiring a costly continual monitoring and evaluation of individual student learning styles. This multiple modality approach, derived from neuropsychology is consistent with a wide variety of learning theories. #3) The discipline of industrial psychology emphasizes goal-setting, the skillful breaking up of a complex task into component tasks each of which is clearly defined, achievable timely, but challenging. #4) Goal setting coupled with the self-efficacy approach introduced by the discipline of social psychology, with an emphasis on perceptions of the self as a key motivating factor in learning, advocate that use of software technology, with numerically differentiated difficulty levels, allowing each student to both self-assess and self-improve with their own actions (self-regulation) The transdisciplinary approach advocates numerous innovations for DI which it is hoped that other researchers and instructors will pursue.

Keywords: *differentiated instruction, executive pillar, universal design in learning, DI, UDL, goal setting, self-regulation, self-efficacy, multiple modalities, attribution theory, software technology, computer assisted instruction, architecture*

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1. Introduction

This paper, employing a transdisciplinary approach, seeks to bridge the gap between the theory that exists for differentiated instruction (DI) and the somewhat overwhelming literature on *how* to operationally implement DI. This section provides the necessary background. It explains what DI is, what it requires, and the challenges associated with it. Later sections which will skillfully integrate results from four disciplines, architecture, neuro-psychology, industrial psychology, and social psychology, will outline an improved approach to DI.

1.1 Differentiated Instruction (DI)

What is DI? *It is the belief that different students optimally learn each according to specific learning styles. If the instructor knew these learning styles, the instructor could then adapt instruction for each student to the particular learning style at which that student learns best.*

Although this description is simple, it immediately identifies the requirements, issues, and tools of DI.

First, DI imposes a responsibility on the instructor. Identifying the learning styles of students in school is considered a teacher's responsibility (Shenoy & Shenoy,2013) Profiling each student enables the teacher to gain a better outlook on how each student obtains information. Additionally, being knowledgeable about the learning styles of individual students helps solve learning problems among students and allows students to become better learners (Sarabi-Asiabar et al, 2014).

Second, DI attempts to meet the needs of a diverse student community since DI addresses a pluralistic student community where all students equally have the right *and* ability to learn.

Third, although DI presupposes that there are models that describe varied learning styles, there is no consensus on which model of varied learning style to use. This leads to an overwhelming amount of literature potentially confusing to an instructor who needs specific but flexible guidelines.

1.2 Learning Theories

One well-known learning model is Tomlinson's Visual-Aural-Kinesthetic (VAK) model, which differentiates learning styles based on the senses. The model posits that some students are better at *v*isual learning, some at *a*uditory learning, and some at hands-on, *k*inesthetic learning (Tomlinson, 1999, 1999a; Tomlinson et al, 2003; Tomlinson & Moon, 2014).

A closely related model is the Fleming-Mills VARK model, which adds to VAK the "R" which stands for w*r*iting and *r*eading. For example, some students learn best from PowerPoint presentations and writing notes (Fleming & Mills, 1992)

A variety of other models address DI through personality classification, for example, the Myers-Briggs Type Indicator [25], the Kolb Learning Style inventory (Kolb, 1976) or the Four Stages for Formatting Lessons (4MAT) learning style model of McCarthy (McCarthy, 1988).

We suffice with describing one of these models in detail, Anthony Gregorc's Mind Style Model (Gregorc, 1982). This model was selected since it is only two-dimensional facilitating ease of description. This model classifies learning style by two dimensions: A) *abstract-example* and B) *experimental-sequential*. A) This model first asks instructors to differentiate students depending on whether A#1) they like to start with the abstract principle and then proceed to see examples or whether A#2) they like starting with examples and then proceed to the abstract principle. B) A second dimension of the model explores whether the student prefers to learn by B#1) first experimenting with alternatives or whether B#2) they prefer to start with mastering a sequential presentation of steps and then identifying why certain alternatives may not work.

The commonality in all these approaches is that both students and instructors learn through seeing, hearing, reflection, action, and thought analysis. DI therefore requires multiple methods of instruction including manipulatives, educational technology, audio visual aids, and explicit expectations (Lawrence-Brown, 2004).

A concise and pedagogically sound summary of the values, assumptions, and beliefs underlying DI is provided by Landrum and McDuffie (2010) basing themselves on Rock, Gregg, Ellis, and Gable (2008) who in turn based themselves on Tomlinson's original work (Tomlinson, 1999, 1999a; Tomlinson et al, 2003; Tomlinson & Moon, 2014).

DI is based on four guiding philosophies which include:

a. A focus on vital ideas and skills in each subject area,
b. Openness to individual student differences,
c. Incorporation of assessment and instruction, and
d. Ongoing adjustment of content, process, and products to meet the individual students' levels of earlier knowledge, critical thinking, and expression styles (Rock, Gregg, Ellis, & Gabl, 2008, pg. 33).

DI, according to Tomlinson, has seven essential beliefs:

a. Same-aged students are ready to learn to *differ* based on their different life experiences;
b. These *differences* have a strong effect on their learning;
c. Students' learning is heightened when teachers challenge them beyond their independent level;
d. Learning is more effective when related to real-life situations;
e. Student learning is enhanced by authentic learning opportunities;
f. Student learning is increased when they are respected and valued by their teachers, school, and community; and

g. The goal of education is to recognize and promote the upmost abilities of each student.

These philosophies and beliefs allow instructors to differentiate instruction by adjusting the content, process, and products based on students' readiness, interest, and learning profiles (Rock, Gregg, Ellis & Gabl, 2008).

The consensus of the literature is that DI does work, it improves both student performance and student satisfaction particularly when instructors are appropriately trained and educated resulting in a feeling of comfort with DI (Bogen, Schlendorf, Nicolino & Morote, 2019).

2. So What is the Problem?

The *theory* presented in Section 1 is sound and appealing. However, the problem is *operational*, not theoretical. *How* does one implement the theory? Several obstacles arise.

2.1 Problems

``The amount of empirical research conducted in the area of differentiated instruction is overwhelming (Shareefa & Moosa, 2020). Additionally, the practice of DI has become a challenge and has made the role of teachers complex (Tomlinson & Moon, 2014).

To clarify the issue of complexity, recall a basic tenet of the psychologist and cybernetician Ashby (Ashby, NA). Ashby pointed out that we have a tendency to use words and phrases such as "higher cognitive" "pedagogically challenging" even though these phrases do not have well-defined meaning. Ashby therefore advocates for a more specific and descriptive approach when dealing with psychological issues. Ashby, in fact, advocated eliminating terms such as *higher order* from psychology and replacing them with more mechanistic and operational concepts. In so doing, Ashby was not trying to remove complexity from psychology, but on the contrary, trying to preserve it in a more efficient manner that can be utilized by practitioners.

To illustrate the application of Ashby's viewpoint to DI, several excerpts from recommendations to instructors are given below:

> The teacher: a) *continuously* monitors student learning, b) *collaborates* with learners, c) implements *relevant* learning experiences, d) accesses *family and community resources*, e) *varies* his/her role, f) provides *multiple models and representations,* g) guides students' engagement and learning by using a *range of learning skills and technology,* h) uses a *variety of instructional strategies* (InTASC, 2013, pg. 38).

The italicized words highlight the issues on which Ashby has criticism. Certain recommendations are too-time consuming for instructors (for example, *continuously;* or use of *family and community* to fully implement *resources*). Other recommendations (InTASC, 2013) do not give adequate and complete specificity (for example such recommendations as *multiple models, ranges, variety* are general and do not give a busy instructor specific advice on how to completely achieve these ranges and variety, though advice and models are later presented).

These particular citations come from the description of recommended teaching strategies in the model core teaching standards of the Council of Chief State School Officers (CCSSO), through its Interstate Teacher Assessment and Support Consortium (InTASC). This type of critique is not unique to this set of standards; it could equally apply to many other established standards. To echo Ashby's concerns, the theory is sound and appealing but does not give the instructor specific guidance to follow that is *implementable in real time*.

2.2 Goal of this paper

Therefore, the goal of this paper is to present a specific, operational, and implementable method for creating DI. The development of this methodology suggests new ideas on how to best approach DI. Since this paper is theoretical, not experimental, other researchers are encouraged to experimentally investigate, confirm, and/or modify these suggestions. However, as appropriate, anecdotal evidence from the author's teaching practices or the literature will be presented.

3. Psycho-Neurology and Challenge

Prior to presenting the psycho-neurological approach, we briefly discuss the history of measuring pedagogic challenge and recent attempts at unification of superficially different measurements.

The idea of pedagogical challenge was first formally introduced and defined in Bloom's seminal work (Bloom, 1956). Bloom introduced the educational hierarchy. The hierarchy, as its name implies, is a set of stages (for Bloom there were six), the earlier stages dealing with lower cognitive instruction involving memory and recall, while the higher stages deal with higher cognitive instruction, such activities as analysis and synthesis. In this way, any piece of instruction or any piece of assessment can be evaluated as to its place in the Bloom Hierarchy. Theoretically, this should allow instructors to improve their education.

The Bloom hierarchy was followed by several other educational hierarchies from other researchers such as those of Gagne (1985), Van Hiele (1986), Anderson and Krathwohl (2001), and Marzano (2001.

Each of these hierarchies requires training to use them. For example, the *analysis* stage in Marzano's hierarchy is indicated by such concrete activities as *sorting*, *classification, matching, error detection, etc.* Thus instructors must first familiarize themselves with the basic levels of the hierarchy and then familiarize themselves with the sub-levels associated with each level.

The idea that these educational hierarchies might be measuring the same thing – that is, they differ in nomenclature but not in substance – was first explicitly stated by Yazdani (2008) who showed that the Gagne and Van Hiele hierarchies were equally successful in improving student performance.

Following this lead, Hendel, in a series of papers culminating in a book (Hendel, 2017) sought to i) unify the hierarchies in terms of underlying neuro-psychological processes and ii) adhere to Ashby's criteria for mechanistic and descriptive accounts.

Hendel identified four educational pillars that unify the hierarchies and are mechanistic in nature while simultaneously being broad enough to capture the need for flexibility in educational delivery. The four educational pillars are

- Executive Function (EF)
- Goal Setting
- Attribution Theory
- Self-efficacy.

Each of these pillars is briefly described in the next four sub-sections. After presenting the theory, it will be seen that these pillars, with little extra effort, already meet many of the needs of DI.

3.1 Executive Function (EF)

EF is neuro-psychological concept that refers to at least 8 distinct mental capacities (Pickens, Ostwald, Murphy-Pace, & Bergstrom, 2010). These 8 capacities naturally combine into two distinct groups (Toplack, West & Stanovich, 2013). Both groups of EF have in common that they are mental activities that deal with multiple parts of the mind.

> *Open EF* refers to the capacity of the mind to solve open-ended problems. A typical example (occurring on EF tests) is the following: "You are on vacation and just noticed that a medicine you must take daily is not with you. What do you do?" There are a variety of answers to this question (i.e. it is open) which the evaluator scores according to specific criteria.
>
> *Performance EF* refers to simultaneously using several *specific* parts of the mind. For example, finding the maximum of a function might involve computation and visual inspection of a graph or table. Throughout our discussion of education, EF refers to performance EF.

Although EF is the name of the underlying psychological process, it is known to educators by a variety of other names. Such phrases as *multiple modalities* or *multiple representation methods* are used in the various standards such as those of NCTM (2000), CCSS (NA), Council for Educational Children (CEC) (Friend & Bursuck, 2006) and InTASC (2013). Consequently, all established standards advocate engaging multiple parts of the mind, that is, using EF, as intrinsic to good pedagogy.

Other individual researchers have independently discovered EF without explicitly referring to it in a neuro-psychological context. Hughes-Hallett, who significantly reformed Calculus education, advocated the *rule of four* for mathematics education, which means that each class example and each assessment vehicle, should engage four mental areas, the verbal, visual, formal (algebraic), and computational (Hughes-Hallett et al, 2013; Knill, 2009). As a simple illustration, Hughes-Hallett points out the error in teaching calculus students how to obtain a maxima using formal methods, without also showing these students how to identify the maxima from a graph, table, or a verbal problem.

The VAK (Tomlinson, 1999, 1999a; Tomlinson et al, 2003; Tomlinson & Moon, 2014). and VARK (Fleming & Mills, 1992) models of learning in DI are EF in disguise. Here the multiple parts of the brain each correspond to one sense, such as visual, auditory, kinesthetic, reading and writing.

Although the full application of the four pillars to DI will be fully developed in a later section, the satisfaction of Ashby's criteria of a specific and mechanistic description can be immediately seen. Indeed, to implement EF in the classroom (or assessment), an instructor has a specific finite number of areas to address: They include, visual, auditory, kinesthetic, reading/writing, etc. and this in turn implies that the instructor's toolkit should use such techniques, as PowerPoints, videos, manipulative materials, educational technology, graphic organizers (such as matrices) etc. The emphasis in this analysis is on the finiteness and specificity of what has to be mastered by the instructor.

As mentioned earlier in the paper, although this paper is theoretical, it suggests and encourages future research. Based on the above theory this paper conjectures that i) the driver of DI is EF, and ii) an experiment involving two treatments by two control groups, one using a fixed list of EF categories and the second using a non-fixed group of DI, would have similar effects (negligible or small difference) on two classes being instructed.

3.2 Goal Setting

Industrial psychologists use the term *goal setting* to refer to the breakup of an instructional task into a sequence of steps that maximizes goal accomplishment (Locke & Latham, 1990; Locke, Shaw, Saari & Latham, 1990). Goal setting is classified as psychological since it studies how the sequencing of subtasks affects human motivation so as to maximize performance.

The literature on goal-setting, which applies equally to the business world, teaching, and one's personal life, is enormous. Books differ in what attributes good goal-setting should have; as many as 10 attributes are found in the literature. Hendel (2017) summarizes them with three key attributes:

- *Clear and specific* (a person can be told the goal and know exactly what is required without needing to ask questions)

- *Timely achievable* (the subgoal should be achievable in a short amount of time)

- *Challenging* (this is often overlooked: Good goal setting must be beyond a person's capacity and stretch them; we will revisit this when discussing DI in future sections).

3.3 Attribution Theory

Attribution theory posits that students learn best when they perceive their evaluation as due to internal, controllable, stable causes such as effort and work (Wiener, 1985).

Contrastively, a student does not do well if they perceive that evaluation is due to luck or whimsical feelings of the teacher. Attribution is closely related, perhaps a direct consequence, of self-efficacy a key concept in social psychology that is discussed in Section 3.4.

In passing, we note that a core principle of DI is *respect* for the student. Although *respect* has meaning, it is not typically mechanistically defined in the sense of Ashby. However, using attribution theory, *respect* can be specifically *defined* to mean that the instructor-student relationship is based on an evaluation based on internal-controllable factors like effort and work. Contrastively, if an instructor, for example, belittles a student's chance to succeed because they are kinesthetic in their learning style and not visual or auditory, then the instructor has communicated to the student that his/her success depends on external factors over which the student has no control, namely, the instructors' preconceived notions of what a good student learning style is; the student is not being evaluated based on effort but rather on the whims of the teacher.

3.4 Self Efficacy

Self-efficacy is a key psychological construct introduced by Bandura (1997) the founder of Social Psychology. Self-efficacy refers to the student belief that with the student's current skills and efforts (s)he can accomplish a specific task. In contrast to the Freudian theories that unconscious drives motivate people, Bandura posits that self-efficacy is the single most important driver of success.

Self-efficacy has well-understood drivers. There are six drivers of self-efficacy, the most important being performance successes (a.k.a. practice). Role models and verbal methods are two other important drivers (Hendel, 2017).

The following vignette is illustrative of the self-efficacy cycle. It is also important for the discussion of DI in the next section.

> Nair et al (2012) present the *tree-writing method* which uses a visually represented concept map to assist in narrative writing. More specifically, students given an essay assignment, are taught to take the topic idea (a one to three-word phrase), place it on a sheet of paper, and circle it. The student then jots down other ideas which develop this topic idea, and circles them. Each circled idea is connected by a line to the circled main topic idea. A second round of ideas is then placed on the paper (each, one to three words), circled, and connected by lines to the theme-development ideas connected to the main theme. This concept map serves a basis for the student to write the essay.

Nair et al observed the following *self-efficacy cycle* arising from application of the tree-writing method.

> *Instructor presentation of the tree-writing method ➔ student learning of the method ➔ Reduced writing anxiety (arising from method mastery) ➔ <u>Increased writing</u> (arising from reduced anxiety) ➔ greater writing proficiency (arising from increased writing) ➔ increased self-efficacy in writing (arising from greater writing proficiency) ➔ <u>Increased writing</u>*

We can understand this vignette using Hendel's four pedagogic pillars as follows:

- <u>EF</u>: The tree-writing method applies EF to writing by engaging the visual (tree) and writing part of the mind.
- <u>Goal setting</u>: The writing of the composition has been decomposed into a sequence of steps each of which is clear, timely achievable, yet challenging [The steps are i) topic sentence, ii) development ideas, iii) drawing circles and connectors, iv) iterating ii) and iii), v) transforming the visual tree to a composition.]
- <u>Attribution theory</u>: Student success in writing now depends on application of a method. Thus attribution theory expects improved learning because the process is internal and controllable.
- <u>Self-efficacy</u>: Self-efficacy increases primarily because of increased performance, the major driver of self-efficacy.

This vignette is important for the discussion of DI. The paper presenting the tree-writing method (Nair et al, 2012) does not at any point discuss the capacity of the students. For example, the paper does not communicate whether the students were visual or kinesthetic (writing). Rather the point of the paper is that by *initially* combining both visual and kinesthetic elements in instruction, the class as a whole improved. It was not necessary, for example, to interview each student and profile their learning style, which while very often worthwhile, is a time-consuming and complex procedure.

What emerges in this particular example is that DI was accomplished by initially using multiple modalities of presentation and, so to speak, bypassing evaluation of students. Apparently, providing the multiple modalities was sufficient in this example to differentiate learning. It is invisible to the instructor how much each student benefitted from the visual and the kinesthetic. This approach synergistically synthesized a whole that is capable of addressing differentiated instruction without elaborate evaluation and multiple strategies. Only two strategies were used, visual and kinesthetic, which apparently sufficed for the students taught writing in this study; it is very reasonable that the *tree-writing* method can also be adopted to students with other learning needs.

This analysis is continued and summarized in the next section.

4. Applications to DI

4.1 Universal Design

Prior to discussing the proposed approach presented in this article for DI, we first discuss the current approach to DI which uses the universal design in learning (UDL) approach.

Friend and Bursuck (2006) trace the history of the important educational approach of UDL to architecture. Architects found it costly to create a building without prior due diligence and *then* find out that regulations required accommodations (for example, staircases and rails) for certain types of people . It was cheaper they found to use a universal approach to architecture under which the building was designed with the expectation that a wide variety (in fact a universal) set of people would use it. Such an approach meets the differentiated needs of multiple dwellers while costing significantly less.

This idea was adapted to education in the UDL movement which requires an instructor to plan for a universal group of students *prior* to meeting his or her class. This maximizes the needs met and minimizes needed instructor effort.

However, as pointed out in earlier sections, this approach requires that an instructor familiarize himself or herself with all learning theories, all learning types, and more importantly, with the learning profiles of each of his or her students. But then the quest for universal design has been implemented by a time-costly approach requiring obtaining familiarity with each individual student through a thorough diagnostic interview.

We have illustrated above, in the discussion of the tree-writing vignette, how the profiling of each student can be bypassed while still achieving DI.

In the next four sections, we examine how the four educational pillars of Hendel [12] provide an alternative approach to DI, that is implementable.

4.2 Executive Function (EF)

To recap the discussion in Section 3.4, this paper argues that for DI purposes it *suffices* for an instructor to plan instruction using EF or multiple modalities of presentation. The instructor should assure a specific set of presentation modes are met including visual, auditory, kinesthetic, verbal, and reading/writing. However, the instructor need not profile each student; on the contrary, because the instructor addresses multiple modalities the instructor can be assured of universal access, that is, that each student's needs will be met by some modality.

To clarify the nature of this conjecture, consider three treatments, T1, T2, T3:

T1) An instructor teaches using one method (e.g. lecture);

T2) The instructor teaches using multiple modalities and addresses multiple parts of the mind; treatment T2) does not require the instructor to interview *each* student to determine his or her individual needs; however, T2) allows interviews for targeted students when needed, for example, those students seeking extra help during office hours;

T3) The instructor interviews *every* student and *as a consequence* creates instruction based on their needs.

The literature supports the expectation that treatment T1 will have significantly poorer results (student performance and satisfaction) then treatment T2 or T3 [5]. This paper further conjectures that there will be negligible or only a small improvement in using treatment T3 over T2. Therefore, since T3 is burdensome timewise to implement for an ordinary instructor, T2 is preferred.

Although this is a conjecture, and although it is very possible that the difference between T2 and T3 is not negligible, there is anecdotal support for the conjecture. First, the tree-writing method [26] anecdotally supports this conjecture. Second, the author relates the following about his implementation of treatment T2: The instructor’s use of multiple modalities:

i) Has led to certain student types seeking extra help during office hours;

ii) Requires the instructor to be clear that evaluation on examinations is dependent on a correct answer with appropriate work, thus allowing student flexibility; however, on homework assignments the instructor may require specific methods for purposes of exposing students to these methods;

iii) Allows students to change their learning style; although the literature does not seem to acknowledge this, the author has found that students are not *fixed* in their learning styles.

Thus this approach shows that while accommodations consistent with different learning styles do have to be made, they are not time-costly but rather specific to individual students.

4.3 Goal-Setting

The author has personally shared application of DI with the students and encouraged student self-regulation, that is, an encouragement that students create their own schedules and their own assessments to create an individual trajectory for learning mastery. The importance of self-regulation for learning is known (Kitsantis & Zimmerman, 1998, 2002)

The author's students must prepare to take and pass the difficult Society of Actuary (SOA) Examinations (SOA, 2019). The author's classes use a simple software package that has a databank of questions classified by topic and difficulty.

The author's instructions to students (after uniform teaching during the semester) are as follows:

i) To pass the SOA examination you need to score 70% or higher on 30-35-question tests consisting of questions with difficulty levels 4,5 and 6.
ii) Each student should start at a level where they achieve high scores; this might be level 1 or 4 for different students.
iii) After acquiring proficiency at a given level the student should advance to the next level (Here we expose students to the *challenge* aspect of goal-setting)
iv) The instructor (me!) is not needed unless you get stuck for a few days at a particular level and at a particular score range. This would indicate that you need some extra tips on how to approach certain questions.

This setup has worked well for the author and his students. The instructor becomes a *coach backup*, someone to come to when published solutions and instructional materials do not suffice. Each student has differentiated instruction for their particular level; importantly, the students are regulating their own DI.

This paper conjectures that experiments with two treatments, one with instructor regulated DI and one with student-regulated DI, such as just outlined, would show negligible or small difference.

4.4 Attribution Theory

Section 3.3 has already identified the vague concept of *respect* with attribution-theory concepts. The author shows *respect* for his students by awarding full credit for any solution method used on an examinations that leads to a correct answer even if that method differs from the instructor's preferred method.

4.5 Self Efficacy

The relationship between DI and self-efficacy is noted in the literature [Aljaser, 2019; Nair et al, 2012]. Since self-efficacy is considered the most important contributor to success (Bandura, 1997) more studies should be made on how DI drives and increases self-efficacy.

This author's anecdotal experience is that the simple use of self-regulated learning just described is sufficient to boost self-efficacy and improve performance. While this is conjectural, it seems fruitful to make this into a research study.

5. Conclusions

This paper has reexamined DI using the four disciplines of architecture, neuro-psychology, industrial psychology, and social psychology. The application of these disciplines resulting in Hendel's four pedagogic pillars allows reformulation of DI. It also leads to pedagogic innovation. This innovation has been summarized throughout the paper in terms of areas of possible future research, treatments, and experiments.

The key conclusions of this paper are that DI can be accomplished without student profiling by:

i) Addressing EF, that is, providing multiple presentations of instructional material,

ii) Adhering to assessment evaluation based on effort and work

iii) Sharing application of DI with students, and encouraging self-regulation and

iv) Emphasizing self-efficacy.

These ideas steer DI in new directions and, perhaps, will inspire further studies.

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