

The Take-Away Technique for Increasing Higher Order Learning and Achievement

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Abstract

Take-Aways are the key messages and meanings learners derive from presentations and learning interactions of all kinds. Cognitive learning theory Take-Aways are not prescriptive; rather they are extracted and constructed by the learner at the conclusion (backend) of a learning session. Little research has been done on how the backend of the learning process concludes for the learner. This article describes the Take-Away Technique and the learning theory upon which it is based and summarizes the results of 3 exploratory studies of the technique done at the high school, undergraduate and graduate level using science and social science content. In all three studies the Take-Away Technique significantly increased higher order achievement independent of aptitude and writing ability levels, as predicted, and 73% of the students across the three studies reported that the technique improved their comprehension and retention of the content studied as well as their studying and expressive skills, again as predicted.

Keywords: higher order learning, achievement enhancement, written summarizations, learning character, self-directed learning, anxiety optimization, meta-cognition, long-term memory formation, science and social science learning

1.0 Overview

If one has training in business, advertising, marketing, political science, funding raising or campaigning, one most likely is vaguely familiar with the concept of the “take-away” in any (content) presentation or interaction, and its key importance as an evaluative and effectiveness criterion for summarizing the critical essence of the interchange and its key messages, whether it is a live presentation, or a casual or group conversation or discussion, or a web-page or series of web-pages or a lecture or a chapter in a book. However, if you are in education, you might not be familiar with the concept of the “take-away” or its key and critical importance in the teaching-learning exchange, and the critical “back-end” of the learning process; namely, what happens and what students do *after* a presentation or interchange or learning session is done.

From the point of view of contemporary cognitive learning theory (e.g., Pinker, 1997, Ashcraft 2002; Martinez, 2009; and Sternberg and Sternberg, 2012), the “back-end” of the learning/instructional process would be post learning processes and activities that organize, elaborate, consolidate, connect, and incorporate what the student *should be taking away* from the exchange into the student’s long term memory via assimilation and/or accommodation processes (see Meeter and Mure, 2004 for details). The critical difference here, however, is that contemporary cognitive learning theory contends that all of these “back-end” processes ***should not be prescriptive*** (namely, done by the instructor or the instructional agent), ***but rather that they should be actively done by the student (i.e. the learner or information processor)***, and that such “back-end” processing should be ***a meta-cognitive habit*** that is developed in the student to the point that it is an automatic and highly active part of the student’s everyday information processing activities. In this regard, then, the instructional or cognitive “Takeaway” is very different from other forms of the “take-away,” and the cognitive learning theory form of the technique is very different than other forms and views of the technique. Very little research has been directly done to date on the cognitive Takeaway or Takeaway technique, and very little theory about the technique has been formalized.

This article, therefore, will first formalize some of the theory needed to understand and test the cognitive Takeaway and Takeaway technique (which is the invention of this author) in series of exploratory and experimentally oriented studies, and then it will summarize the results of the first three such studies that have been done to date which examined a key set of initial questions about the technique and its underlying theory.

2.0 Takeaways

Takeaway (food), in British slang, is a consumable (nourishment, hopefully) prepared by others that you actively ingest, digest and benefit from (unless they are empty calories) usually sometime after the preparation processes and in a different place than the events that produced the Takeaway (food) occurred (otherwise it is “swag from a job,” which is an equally important metaphor and concept as swag is actually someone else’s property and a form of cheating). One can deconstruct this Takeaway metaphor in several important and different ways to develop the concept (which will be done later), but the most important point relative to this implied procedural and visual metaphor is that “Cognitive Takeaway” *is (or should) be produced by the learner/information processor (i.e., student) and not the teacher (i.e., environment) or teacher surrogate (e.g., textbook, teaching assistant, friend, parent, classmate, post-instructional handout or email) or any other anxiety-reducing agent that promotes learned helplessness (syndrome) in the learner, which is one of the hallmarks of overly prescriptive (and usually non-cognitive) learning and instructional theories. In a word, “cognitive takeaway” is when you feed yourself and cook your own nourishment (meanings, understanding, knowledge) and clean up after yourself too (i.e., correct your errors, misconceptions, misunderstandings and other messes from the feedback you receive or testing of your understandings that you do, one form of which is communicating with others).*

So implicit in the concept of the Takeaway is the first fundamental principle of cognitive learning theory which is, “Learning is a Do-It-Yourself-Project.” Implicit in this first principle (or slogan), then, is explicitly making the learner responsible (in part) for her or his own learning and the cognitive and meta-cognitive skills, processes, and activities that create the learning from the “hum and buzz” of the instruction experience and events. The active learner is at least a lip-service part of all theories of learning and instruction, but the *responsible learner* is only a key feature and hallmark of (most) cognitive theories of learning. The cognitive Takeaway, then, is based on the concept and theory of the learner being continuously active and a continuously active processor during instructional experiences and not an intermittently or occasionally active learner or information processor, as is characteristic of the majority of learners in highly prescriptive and over supported instructional processes (see Ashcraft, 2002 for details). Highly prescriptive instruction is a type of instruction which tends, as a broad and loose generalization, not to resemble real world adult learning and learning contexts and situations (see Author, 1997 for details). This key point, therefore, brings one to the second general principle of cognitive learning theory.

The second general principle of cognitive learning theory is, “You are supposed to learn in spite of the environment you are experiencing.” Again, one hears the responsibility theme in the second principle, but with the added caveat of becoming even more responsible, as well as savvy about compensating for and overcoming relatively noisy, turbulent, chaotic, and not-neat-with-a-bow-on-it (and-exactly-what-I-need-to-know-for-the-test) experiences and streaming (multimedia) messages of all kinds; namely, the very essence of what the entire cognitive apparatus is supposed to be for and do (see Hauser, 2009 for details). Again, in a word, if one does not give the student at least part of the responsibility of de-noising, organizing, elaborating and understanding “instructional” experiences and messages, and the opportunity and responsibility of doing so and practicing this set of skills and strategies, then how does one expect the student to develop these skills and strategies before being out there in the adult world of work and life and in sink or swim situations?

This notion or view of *cognitive engagement* is really much more important than typically realized, and it is actually a prerequisite of successful social engagement, which is the current soup-de-jour in higher education now if not K-12 education. Just as overly clean childhood environments produce asthmatic adults, overly prescriptive instructional environments tend to produce overly dependent, intellectually passive and helpless adults who tend not to be inventive, problem solvers, or self-directed producers as opposed to consumers of knowledge and understandings. Consequently, learning to construct good cognitive Takeaways, a primary cognitive and meta-cognitive skill set, promotes the transfer of various learning responsibilities and their development to the learner, and thus makes the learner accountable in some kind of measured part (or context determined percentage) for her or his own learning and development.

The cognitive Takeaway, therefore, promotes the development, practice and habituation of cognitive engagement and a fuller set of self-directed (or loosely guided) cognitive engagement skills and strategies, and particularly so as compared to more prescriptive instructional theories and instructional practices. The Takeaway, then, could be said to be directed at developing *learning character* (Carifio, 2005), which is a generic and emerging concept in several different contemporary schools of instructional and learning theories.

It should be clearly noted that the cognitive Takeaway in and of itself is not going to produce the transformations cited above overnight in some kind of wholesale or magic fashion. The technique is just one small (but highly flexible) strategy for promoting the kind of learning responsibility, engagement and character development briefly described and elucidated above. Additionally, it should also be noted that the summaries presented of the studies done to date on the technique are just the initial exploratory investigations of the technique and the class of techniques that could be called cognitive engagement or learning character building techniques, and these studies have been designed to focused on answering only a few initial and important baseline questions about the technique and its effects. The next question, then, is, “How do I recognize a cognitive Takeaway if I encounter one or am required to produce one?”

2.1 Distinguishing Features

Given the broad view of Takeaways and the Takeaway technique outlined above, it is important to distinguish Takeaways from other seemingly similar instructional techniques such as journaling, reflective writing, and various forms of “homework” and “out-of-class” assignments, and then to characterize Takeaways and their operations in terms of a standard model and theory of information processing and cognitive learning (see Carifio, 2005 for details). From this vantage point, it will also be easier to both report and understand the methodology and results of the initial studies of the technique that have been done to date.

The Takeaway is often and typically confused with journaling and reflective writing techniques. It is neither, in theory and fact, and this construal of the Takeaway is both a misconception and misunderstanding of the technique and one of considerable importance. The Takeaway is more fundamental and more focused cognitively and conceptually than journaling and reflective writing, and it is concerned with the very basic cognitive and meta-cognitive skills and strategies of continuously extracting messages and meanings from informationally dense and complex dynamic environments (to the learner primarily) that are somewhat noisy, ambiguous, chaotic and changing (e.g., a class, interactive lecture, reading on the web, or a textbook chapter), and then selecting out what is most important, core and fundamental (or weeding out what is not most important), for the next key step of the Takeaway process which is organizing and relating the core meanings together into a whole (or proto-schema), and then summarizing or *précising* this self-constructed whole in a short communication or message that can be understood and evaluated by someone else (the “Turing Test” component of the technique or assignment).

The hallmark of the Takeaway and the Takeaway technique, then, is the *reduction and compression* of “thick and rich” information and “buzz” to its essential essence, which is essentially “*factor analyzing*” the (learning) experience cognitively and logically. Therefore, the Takeaway technique, in the many different and varied forms it may take, requires the student *at a minimum* to extract, organize, summarize and express in a form that is understandable by others the key and critical meanings and messages in a learning exchange, as well as the important *relationships* between the key meanings and messages, which is *structural knowledge* and thus a schematizing of the new meanings and messages that relate to and interact with existing schemas, which in turn begins to produce elaborations or modifications of existing schemas if required. This very restrictive form of “writing,” which is actually very active, focused and highly constrained information processing, therefore, is not journaling or reflection writing as defined by Hubbs and Brand (2005) and Kalman and Klamann (2005) but an activity and post-learning or post experiencing activity that is quite different in its primary attributes, characteristics and underlying theory (see Carifio et al, 2013 for further details on these points).

The cognitive Takeaway technique in theory, therefore, models the very act and essence of cognitive information processing (and theory), and it is highly focused and constrained *implicitly* in the “product” to be made by the student, and what counts as an acceptable and correct product, whether the Takeaway is in “list or bullet points form,” an actual concept map, diagrams or chart, sentences or complete paragraphs or paragraphs that are academically acceptable, which is a “sliding scale of forms and difficulties levels” Takeaways can be, depending upon the situation and context of their use and the goals of instruction.

Further, the very act of producing a Takeaway is directed at initiating a critical step in the production of a long term memory of the informational product constructed by the learner under the conditions of *moderate to high anxiety* (as the learner is actively making the product in an implicit 'test-like' event rather than just passively receiving a product made by someone else that may or may not be attended to or processed 'deeply'), which has been shown to be a critical factor in long term memory formation and retention (see below and Meeter and Murre, 2004 for details and a review of this literature).

The Takeaway technique, then, is about post learning processes (of assimilation, accommodation and long term memory formation) and the process of bringing closure to learning events and experiences and doing so in a formal and less ambiguous fashion and manner than what is usually or typically done in such situations and particularly when they are more passive and informal in character. Further, the cognitive Takeaway technique is about performing post learning processes and the formal bringing of closure to learning events and experiences in (*optimized*) *high stakes conditions* rather than low stake conditions, as optimized high stakes conditions should maximize all of the outcomes sought and particularly higher order learning and long term memory formation in theory, given Meeter and Murre's (2004) recent review of the literature on stress and post-learning processes and outcomes. Further, if the learner has not done the "front end" of the process (e.g., come to class, done the reading for the class if the class is skipped), and been actively cognitively and responsibly engaged in the learning experience in question, then she or he will find it quite difficult to produce the Takeaway for the learning experience required. This particular student will also find this particular Takeaway to be frustrating, emotionally upsetting to some degree and a very clear signal that she or he is not performing to minimum standards and progressing in the manner and at the rate that she or he should be progressing and functioning, *whether any external feedback is given to the student on the Takeaway or not*.

As Thorndike (1935) and Paige (1954) long ago demonstrated, executing a task most often is all that is required to provide most (young adult) learners with some helpful and useful information on how they are progressing on the mastery of the task in question. So instantaneous feedback and/or correction are not necessary components of the Takeaway and may actually diminish its effectiveness given the research on wait-time and learning, but this point is an empirical question yet to be answered. Consequently, the Takeaway technique should be particularly effective in introductory and/or high-risk courses where students do not have well developed schemas and prior knowledge of the content or area to be learned, and the content is fairly complex, difficult and dense in the sense of the amount of content to be learned, and/or the students have not developed the cognitive and meta-cognitive skills they need to handle and be successful in such a course, context, or learning environment.

As can be seen from the above description and characterization, Takeaways are quite different from journals, journaling, reflective writing, short or long paper writing and similar assignments and activities, and this is an important distinction for students to understand (see below for details), as well as teachers, as most students are familiar with these other forms of writing, which can induce an initial misunderstanding of the Takeaway which is quite different. Also, somewhat parenthetically, as a technique, Takeaways should be first introduced to students in middle schools rather than in college, as the cognitive and meta-cognitive skills development embedded in the Takeaway technique is in part what the transition from the concrete to the formal reasoning level of cognitive development is about in several different ways. Also, at the college level, certain aspects of the Takeaway technique are very pragmatic and directed at pragmatic problems of instruction and schooling. For example, the technique is directed in part at getting undergraduate and graduate students to attend class regularly and do assigned reading regularly and on time without having to *directly require* either and thus avoiding all of the evaluation and grading rigmarole that each entails if attendance and completing reading assignments are *directly* required.

Students figure out pretty quickly that they have to come to class to do the Takeaways as other people's notes (one kind of "swag") do not really help them that much nor do students want to share their notes because of their implicit sense of fairness and not wanting to reward the "irresponsibility" of other students who do not come to class and participate (a word heard more than once by the end of the semester). A few students will choose not to do the Takeaways (even though they were/are an "easy grade boost" usually) and limit themselves to a B or B+ for the course, but a few of these few students will also just start doing the takeaways about half way through the semester, as they hear about and see the benefits other students are gaining by doing them and developing these skills and using them in other courses as well.

Therefore, there are a number of pragmatic aspects and features of the Takeaway that are intentional in their design and deployment which can vary depending on the context of the instruction and the instructor's preferences. Lastly, Takeaway can be also seen as a "study skill" and/or framed in terms of various study skills models, processes and theories. Such a framing of the Takeaway is fairly reasonable, but limited in that such a framing misses the theory outlined above and about to be added to below, and the richness and variety of potential uses and adaptations of the Takeaway technique.

2.2 Dynamic Working Schemas

"Reading" is both a euphemism and metaphor for many different things, processes, experiences and skills. In general, we talk about "reading" events, environments, and "multimedia" experiences of all kinds, which may be represented as "texts," where the texts may be words, images and visuals of various kinds either singly or in combinations. As events and experiences happen in real time, such texts are both externally and internally (to the processor) *dynamic texts* that are partially organized to some greater or lesser degree, and the reading of such dynamic texts (including this article) is something that unfolds over time with a construal and schema of the text being built up tentatively and dynamically by the reader over time until the conclusion and termination of the event or experience. During the event or experience, the "reader" or "processor" has a dynamic working construal and schema of the "text" being experience which is at first partial and then (hopefully) increasing more developed and instantiated until the event is concluded (always temporarily), at which time the dynamic working schema is "fixed" either vaguely (and quickly forgotten) and more formally (and better remembered). If the experiences are chapters in a book or classes in a course, the dynamic working schemas are more macro and unfold over time with only temporary and probabilistic fixings and subsequent modifications, or at least so by the more active and savvy processors.

The dynamic reading metaphor is a very useful and helpful one for looking at instruction and learning, and instruction and learning in an academic context, as both reading and the process of reading are and have been very well studied and have formal cognitively based and cognitively oriented models and theories of reading, the reading process and text processing which include understanding, meanings, schemas, scripts and storylines as well as inferences, deductions, elaborations, emotions, values and feelings that are well supported empirically and in some quarters even considered to be "cognitive psychology" relative real world learning and information processing (see Kintsch, 1986, Van Dijk, 1980, Dagostino and Carifio, 1994, Graesser et al, 1996, Kirby, 1984; and Kirby and Savage, 2008 for models and details.). In particular, the text processing models and theories of Kintsch, Van Dijk, and Kirby have strongly influenced the development of the takeaway concept and its underlying theory.

Seeing all events and experiences as "text processing," and all students as active processors and authors of their own macro working schemas and working memory products and summaries (i.e., gist) is to acknowledge and make explicit attention, perception, working memory and executive processes in learning, and the simple but often forgotten fact that few ("intellectual") messages are copied (transferred) from the environment to long term memory directly and automatically, but rather go through stages of processing, where various characteristics of the learner/processor affect most aspects of the message and its construction and transformations, and particularly so when the messages are academic and didactic in character. It also explicitly emphasizes that these stages and processes must be managed and well managed, and particularly so by the learner (as the environment simply cannot do it well enough or reliably enough), and thus the often forgotten critical importance of meta-cognition and meta-cognitive (self-management) processes and skills, and particularly so by and in highly prescriptive instruction models and theories of learning (see Dagostino and Carifio, 1997; Paris and Paris, 2001; and Pressley, 2002).

Therefore, helping students to develop the skills to "read" (process information) actively, well, and *continuously* across a learning event and after the event as well and managing this on-going process should not only improve their learning quantitatively, but qualitatively as well in terms of their performance on higher level cognitive tasks, such as essay questions that require application, synthesis, deduction, thinking and problem solving. The problem, then, is one of creating and having a mechanism, device or strategy that requires learners to be active and continuous processors as well as schema builders, elaborators, summarizers and long term memory incorporator in a noisy and dynamic environment. These latter functions are exactly what the Takeaway does or should be designed to do, and midwifing these functions is its very purpose as an instructional device and learning strategy or aid.

Also, it should be clearly noted and emphasized again that the Takeaway is a *student* as opposed to instructor production and a *student* as opposed to instructor created (self) instructional stimulus or “text” as well as trace or evidence artifact of the occurrence of learning or not.

Given the task of producing a Takeaway after each learning experience or event (e.g., class or reading assignment or both) places the student in a comparatively *higher stakes context* where the student cannot just passively sit back with no or very few responsibilities and “channel surf” the environment or experience, as in a more prescriptive instructional classrooms or environments. The student must become active and engaged cognitively, and actively “read” the (somewhat noisy and chaotic) “multimedia streaming text” she or he is experiencing (e.g., the class, lab or reading assignment) and particular so if the learner is a novice in the subject-matter or the instruction is fast-paced or both. In “reading” (processing) a partially organized and partially complete flow of information (which all experience and texts are), the reader/learner must *choose* what to attend to at what level and in what manner, what to select, decode, encode, supplement from long term memory and by thinking processes, and organize for further processing and for constructing a working schema/script of what is being processed at two levels: i.e., a macro schema/script or “the story/experience line, plot or concept map” and micro schemas as well (see van Dijk, 1980; Kintsch, 1986; and Kirby and Savage, 2008 for details). The task and context of being required to produce a Takeaway at the end or after the class is much more difficult, demanding, stressful and high-stakes than pressing a button on a clicker (for example) to answer questions peppered throughout the class (streaming information flow), which is a relatively passive instructional micro strategy and technique, which has its own merits and strengths, but is not as molar and cognitively demanding, high stakes, integrative and schema building as being required to produce a Takeaway.

One might like to be intellectually over protective and do all of these processes and activities for the learner if only to keep her or his mind “healthy and safe” and free from errors and misconceptions, but eventually the learner’s mind must touch reality (the ground) and the real world, and the learner must do all of these things for her or himself and develop all of these processes and skills, and particularly so in a rapidly changing world where new discoveries and new knowledge come in nano-seconds quite often rather than centuries. Sooner is far better than later in making students *in part* their own teachers and responsible *in part* for their own learning with the appropriate cognitive and meta-cognitive skills to do so well. Learning to “read well” is an on-going and never-ending activity and particularly so in a life-long learning model and theory. Being a “poor reader” has far-reaching ramifications and consequences.

So one of the central purpose of the Takeaway technique is to place the learner in a *double-bind situation and environment* where the learner must be an “active and responsible reader” and processor of information continuously and must actively choose what is important, key, and critical in a “reading assignment,” which can be an interactive class lecture or in-class or on-line group discussion, and then summarize what should be taken away from the experience (the core meanings) and incorporated into long term memory. Takeaways are about what meanings and messages are *worth remembering*. The additional question of importance here is why should student-produced Takeaways be more effective and better remembered than instructor generated Takeaways, which are often either ignored or quickly forgotten, over and above the many points that have been made so far relative to answering this question.

2.3 Student Stress, Learning, and Retention

Post-learning processes and activities that help the construction of clear and explicit summarizations not only give the learner “gist” to be stored, but should also greatly improve the quality and precision of the gist to be stored and particularly so if there is a “feedback’ (revision) loop involved, with *targeted revision* being the most effective strategy to use (see Carifio, 2001 for details). Moderate or what is called “peak” stress or anxiety, as the effects of stress and anxiety are not linear (Spielberger, 1972), improves this process and the quality of what is produced to be stored, and, at the same time, it improves storage and retention, so that post-learning processes and their stress and *optimized* stressing of the learner improves the quantity, quality and retention of what is learned and stored in long term memory. There is, however, also a “downside” to this mechanism as it can make the correction or elimination of errors, misunderstanding and misconception difficult for several reasons including the emotional information being yoked to and stored with the errors and misunderstandings.

A variety of research shows that moderate stress improves memory and learning but particularly so if the moderate to somewhat high stress is *after* the learning event, as this stressing affects the biochemistry of long term memory formation, as various hormones produced by this stressing influence protein production and formation, and thus long term memory formation and stabilization (see Meeter and Murre, 2004 for details).

Anything that makes the learning process “too smooth” and the learner too passive and not actively working and actively processing information and constructing new meanings and modify old ones diminishes learning or the probability of change that is more than instantaneous and vicarious and a ‘good feel/time,” and the impoverished and shallow gist formed is never incorporated into long term memory in any concise and more precise way. Learning is hard work and instruction that is over prescriptive and does everything for the learner creates an “overweight and out of shape” lazy learner who will complain if he or she is not being spoon fed and there are not munchies and prizes and awards available for everybody as well. Overly prescriptive instruction de-evolves learners (particularly past the 6-th grade) and creates a very “out-of-shape” learner (and national problem) who has great difficulties when she or he is “put out into the (informational) wilds” of the daily real world and marketplace, where there is **not** an “invisible hand” prescribing, organizing and spoon feeding information and what is important and needs to be learned over the course of each day (i.e., the prescriptive teacher). If the mistake of the 19-th century was seeing children as miniature adults, the mistake of the 21-st century seeing adults as miniature children and teaching them as such; namely, remaining fixation and stuck on pedagogy rather than making the needed and necessary shift to androgogy and facilitating the developments and skills needed to be an androgological learner in the modern world. If nothing else, the pressures of global competitiveness and the daily needs for constant knowledge creation, application and problem solving in a global economy and quickly changing needs for constant knowledge creation, application and problem solving in a global economy and quickly changing world require this shift and new kind of learner and new kind of instruction. The Takeaway is a very small step and strategy for moving instruction in this direction.

3.0 Basic Exploratory Studies Design and Results

The "take-away" technique was initially tested in the spring of 2010 in an undergraduate cognitive psychology class at a public university in New England with 33 students (see Carifio et al, 2013 for details). The students were given the assignment of producing a one-page written *summary* (the minimum) of what they considered to be the key points, exchanges, and messages of the 90 minute class that occurred twice a week *within 24 hours of the class* and to submit their "take-away" for the class to the instructor's teaching assistant. Completing the Take-Away for the class counted for 20% of each student's grade, but students were *purposefully* given minimum feedback on the Take-Aways in order to get an estimate of the effects of the Take-Aways *with minimal feedback and additional work by the instructor*, and to keep the amount of additional instruction received by each student from the Take-Aways at a minimum and roughly constant for each student. Any effects that were observed, therefore, would be **the minimum baseline effects of using the Take-Away Technique**. The instructor did not read any of the Take-Aways students produced until after the course was over in order not to bias results, and the logging of the Take-Aways submitted by these students and scoring them with a simple rubric used for this study was done by a teaching assistant. The instructor sometimes lectured and sometimes engaged the students with Socratic questioning and various class activities directed at illustrating the tenants of cognitive psychology and cognitive learning theory. Students had both required and optional readings each week.

The course had three (3) written *in-class* exams on the readings assigned both before and after class, and the essay exams were spaced five weeks apart. The questions on the exams were questions that required the students to explain and elaborate course content, concepts, principles and theories and to relate aspects of course content together in their written responses. The exams also had one question that was an applications question that required higher order critical thinking. Several other factors were also built into this study and data were obtained on these students which consisted of GPA, Verbal SAT, Math SAT, and SAT writing sample scores. Lastly, *a question on the final exam asked students to cite what they found positive about the Takeaways they had to write (and why) and what they found to be the negatives of writing Takeaways (and why), and what they would do to correct the negatives.*

3.1 Results of Study 1

In this first study, the *quality* of student Takeaways, using a simple scoring rubric, predicted essay exam achievement at $r = +.45$ across the three exams with students being positive about the technique by the end of the course. Students' Math, Verbal, and Writing SAT scores **did not predict** the quality of the Takeaways they wrote (as predicted), or their scores (grades) on the 3 **in class** essay examinations in the course. Student evaluations of the Takeaway technique were congruent with both the model and theory of Take-Aways developed, and students were quite astute about the Take-Aways and their several functions by the end of the course.

The quality of student responses to in-class essay exam questions *improved remarkably* over the semester with students' essay question responses becoming lengthier, more elaborated, coherent, sophisticated, and well written on each occasion, and particularly so for the higher order and more difficult essay questions (see Carifio et al, 2013 for details). Overall, the Takeaway technique proved to be a relative simple and flexible device and strategy that could be used in many different ways to develop students' cognitive and meta-cognitive skills and understandings of subject-matter content, even though the technique has limitations and drawbacks which may be overcome in various ways. As predicted, the cognitive Takeaway was particularly successful with and helpful to students who were novices in the subject-matter to be learned. The results of this minimalist-baseline study were so positive that it was decided to scale-up and extend the exploratory testing of the Take-Away technique, and in a manner that would also answer several currently outstanding questions about the learning of science in high school as well.

3.2 The Second Study

Building on the results of the first study, the Take-Away Technique was next investigated in the fall of 2011 in a suburban High School IE Physics and Physical Science courses for the unit on Newtonian mechanics, given the extremely high priority and concern about STEM learning currently and the fact that very little is formally known about the effects of "writing activities" of any kind by students in STEM courses and physics courses in particular (Keys et al. 1999; Bell, 2001; and May and Etkina, 2002). The suburban high school was large and in the Northeast. The study involved 6 high school physics and physical science teachers and 274 ninth to twelfth grade students, and it focused on the students' understanding of Newtonian Mechanics using the Force Concepts Inventory (Hestenes et al., 1992), the Mechanics Baseline Test as a covariate (Hake, 1998), and the Colorado Learning Attitudes about Science Survey (Adams et al., 2006) as measures of effects and covariates. There was an experimental and control group in this second study. However, classrooms rather than students were randomly assigned to the experimental and control and two of the teachers could only teach one course and they were randomly assigned to experimental or control classrooms.

3.2.1 The Experimental Treatment in the Second Study

Both the experimental and control group in this study received the same IE instruction treatment (except from different teachers) that only differed in one respect. *In the experimental group, students wrote a one-half to one page "bullets-form" Take-Away for each class that summarized the key points relative to the concepts and principles that were covered in the class, whereas in the control group students wrote a one-half to one page evaluation of what they liked and disliked about the class, which was a "control" reflection and a "control" summarizing (experience) that also kept the amount of treatment received by each student constant.* The unit on Newtonian mechanics was four weeks long. At the end of the unit, students completed an evaluation form which indicated the two things that they liked about the take-away assignment they experienced and the two things they disliked about take-away assignment, which was similar to the same two questions asked in the pilot study, so their results could be compared to the results of the pilot study reported above (see Carifio and Doherty, 2012b for full details of this study).

3.2.2 Results of the Second Study

The experimental (TA) group performed better than the control (RW) group on all of the standardized achievement measures using Hake normalized gain scores (see Coletta and Phillips, 2005 for details) by *a quarter to two-thirds of a standard deviation*, which is a very large effect for the TA technique, given that minimal to no feedback on the TA's students wrote were given. The experimental (TA) group students gave the same positive benefits for the Takeaway technique as given by college undergraduates in the first study done with those students in the control group citing much lower rates of these benefits and primarily emotional expression benefits as would be predicted from TA theory.

The increased achievement observed in this study could be attributed **directly** to the Take-Away technique as opposed to other rival hypotheses or techniques like reflective writing or journaling. *The Takeaway technique (and its effects) was found to be clearly distinguishable from the alternative writing technique used*, as it should be according to its theory, and this result was the most important finding in this second study. In this second study, the Takeaway technique was found to enhance targeted understandings and high order learning at a rate of 4 to 1 in the groups that used the technique as compared to the groups that reflected upon and evaluated the quality of the classes they experienced during the instructional unit.

Another important findings of this study was that female students in the TA groups did significantly better on the achievement measures than the females in the control “evaluate instruction and your feelings” groups and as well as the male students in the control group and almost as well as the male students in the TA group. These gender difference interaction outcomes suggest that the Take-Away technique may help certain learners much more than other learners in certain situations; namely, in various contexts, the effects of the Takeaway technique may not be homogeneous or generalized but rather ‘greater than would be expected for certain learner types or profiles. Therefore, this results also suggests that for some learners the Takeaway technique may be a compensatory instructional strategy that help these learners inhibit and circumvent different barriers to learning, achievement and mastery.

3.3 The Third Study

The third study replicated the first study reported above in design except that the course was an *online* 15 week Theories of Learning course for masters and doctoral students conducted in the Fall of 2010 with one group of students (N=22) and the Fall of 2011 with another group of students (N=26). Given the numerous problems and difficulties that have been continuous reported for online courses in terms of students’ inability to manage themselves and their learning well in these types of courses, reports of a high sense of isolation and increased emotions and anxiety as well as lower *higher order* achievement, the Take-Away technique in terms of its underlying theory and the results of the first two studies of the technique would predict that the technique would be quite successful in an online learning environment (see Carifio, 2012a for full details).

The results of this third double replicated experiment were the same as the first study reported above with the quality of the Take-Aways produced by students prior to each test predicting their essay test performance at $r=+.55$, with the essay test average levels significantly increasing across the three tests given in the course, primarily on the higher order learning questions. Although quite positive, I am still somewhat cautious and tentative about these results because of the lack of testing and production security in all work submitted in an online environment and these two semesters of this online course, even though the overall pattern of results are consonant with theory and the results of the first two studies done. Again, GPA and GRE scores (at this level) did not predict the quality of Takeaways students wrote, and again student evaluations of the Takeaway technique were congruent with both the model and theory of Take-Aways developed, and students were quite astute about the Take-Aways and their several functions by the end of the course. Graduate students from both semesters also reported that the Take-Aways helped them to manage their online course experience better, and gave them a clear sense of where they were at the end of each week making them much less anxious and emotional, and particularly so if it was their first online course or two or/and this was their first graduate course or first course in Theories of Learning (see, Carifio, 2012a for full details of this study).

4.0 Conclusions

The three exploratory studies done strongly supported the effectiveness of the Take-Away technique and the theory upon which it is based. The three studies showed that the Take-Away technique improved high order learning and achievement at the high school, undergraduate and graduate level, and in regular classroom and online instructional settings, where both science and social science content were taught. The ability to produce quality Take-Aways were shown to be relative independent of a student’s abilities or/and writing skills as predicted by theory, and were due most probably to other factors that are identified and elaborated in Take-Away theory. The Take-Away technique produced superior achievement as compared to the use of a type of journaling or reflective writing by close to a half a standard deviation, showing that the Take-Away is not either of these writing techniques if done appropriately, and that it is a technique that is focused on the extraction and summarization of the key concepts, principles, points, meanings and their relationships in the content to be learned,

and then structuring them into high quality schemas that are better entered into and retained in long term semantic memory, thereby improving the processing of related content over time qualitatively with each iteration of the process. In the learning of science (Newtonian Physics), the Take-Away technique was shown to improve the achievement of females to the point that they were the same as males in the control group and only slightly less than the males in the Take-Away group.

Across the 3 studies, 73% of the students at all three levels both identified and reported the *primary predicted benefits* of Take-Aways, with 47% of the students saying that the Take-Aways improved their comprehension, and 26% saying that they improved their retention of content.

In terms of the *secondary benefits predicted* of Take-Aways, 27% of students across the three studies reported the top two predicted secondary benefits of Take-Aways, which were improved study skills and improved expressive skills. Across the three studies, 21% of students reported that they were contemplating using the Take-Away technique in the future in other courses they took, and 10% reported that they had already started using the technique in some form in other courses they were currently taking.

It is critically important to remember that all of the effects that were observed in these three studies were the minimum baseline effects of using the Take-Away Technique without the teacher providing corrective feedback on them, or changing their difficulty levels, or altering instruction as it progressed based upon the instructional effectiveness information the Take-Aways provide the teacher; namely, *without additional work or burden for the teacher or the instructor*. This latter parameter was a very important and critical parameter to estimate. These three studies show the effects teachers and instructors can get from using the Take-Away technique doing essentially little different in their teaching, classrooms or courses. It is fairly obvious, however, that all of the effects of Take-Aways observed in these three studies may be significantly enhanced and even accelerated by providing corrective feedback to students on their Take-Aways and/or altering instruction based on the real time effectiveness evidence they provide, all of which are the kinds of further research needed on the Take-Away technique.

Across the 3 studies, 33% of the students at all three levels both identified and reported various problems and difficulties with doing the Takeaways which was in large part due to the experimental designs that had to be used in the three studies to estimate important parameters. However, the chief difficulties reported that are particularly important were those of cognitive load and the time it took to produce a comprehensive quality Take-Away each week or after each class. To some extent these reported difficulties were due to students being asked to engage in an atypical and higher order post-learning activities behavior that was not well developed, practiced and fairly automatic for them and many students did report that it became easier for them to produce a Take-Away each week across the course as it became more familiar and second-nature to them, so there is both a learning and development curve with Take-Aways from high school to grad school. However, the Take-Away technique *is demanding and labor intensive (and it is supposed to be so)*, but given the intense pressures and accountabilities to improve achievement and to close achievement gaps between different priority groups today that would seem to be a *small price* for the achievement gains and gap closing obtained.

The Take-Away technique embodies a cognitive theory of learning and the development of self-directed and cognitively active learning character that is not highly prescriptive and does not “do everything of the learner,” and in fact makes the learner do a great deal of the learning work her and himself in a manner that is *inescapable* (as the student soon learns), as it is the learner who must produce the Take-Away and not the instructor or instructional agent. This view and theory of learning also does not see anxiety, conflict and cognitive dissonance as a “bad thing” and something to be avoided, but in fact sees it as a “good thing” and to be encouraged if optimized and kept in the productive zone (Mandler, 1989; and Erikson, 1993), as it enhances learning and the development of essential meta-cognitive skills (Reivich & Shatte, 2002; and Green & Azvedo, 2007), as well as the formation and strengthening of long term memories (Meeter & Murre, 2004). Further, it is this very different view of learning, instruction and the learner that is the very basis of the Take-Away technique, which has produced superior achievement, meta-cognitive skill gains and understanding, and superior affective outcomes also in three exploratory studies now with more studies currently underway. Effectively using the Take-Away technique for maximum gains, therefore, take a shifting of several of one’s views and beliefs about learning, instruction and students, and understanding that doing *less* for the learner in certain defined and highly focused ways is actually doing more for the learner and in fact much more.

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