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Delivering Instructional Content–at any Distance–is not Teaching

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For some time, educators and others have taught over long distances. The book provides an example of an excellent long distance tool. New means of conveying information provide further opportunities. But in seizing these opportunities, educators tend to confound two aspects of instruction. They blur the means—radio, video, internet, and other means—through which to provide information with the methods—sequencing, prompting, priming, and other techniques—by which that information has an instructional effect. Contacting a large number of students does not mean instructing that same large number. The telecommunication arrangements of long distance education become increasingly sophisticated, but long distance education efforts still operate within the Lecture Model. The Lecture Model constrains new technologies. It prevents solving the core educational problem: achieving high mastery from all students while dealing with their enormous behavioral variability. The problem of long distance education is the problem of education at any distance. Innovation at the tool level, and even the instructional level is not sufficient. The solution occurs only with innovation at three levels of the educational enterprise: its pedagogical technology, its division of labor, and its organizational structure.
Keywords: behavioral variability, Triad Model of Education, instructional technology.

Desde hace tiempo, educadores y otras personas han enseñado a distancia. El libro supone un excelente ejemplo de herramienta a distancia. Los nuevos medios de transmisión de información ofrecen nuevas oportunidades, pero en el aprovechamiento de esas oportunidades, los educadores tienden a confundir dos aspectos de la enseñanza. Se confunden los medios –radio, vídeo, Internet y otros medios– a través de los cuáles se ofrece información, con los métodos –secuenciación, incentivación, priming, y otras técnicas– por las cuales la información tiene un efecto educativo. Comunicarse con un gran número de alumnos no es lo mismo que instruirlos. Los recursos de telecomunicaciones para la educación a distancia son cada vez más sofisticados, pero los esfuerzos que supone la educación a distancia todavía operan en el Modelo de Conferencia. El Modelo de Conferencia limita las nuevas tecnologías e impide la solución del principal problema educativo: lograr un alto dominio por parte de todos los estudiantes mientras se trata con su enorme variabilidad conductual. El problema de la educación a distancia es el mismo problema de la educación a cualquier distancia. La innovación en el nivel de las herramientas, e incluso en el nivel de instrucción no es suficiente. La solución se produce sólo con la innovación en los tres niveles de la empresa educativa: la tecnología pedagógica, la división del trabajo, y la estructura organizativa.
Palabras clave: variabilidad del comportamiento, Modelo Triádico de la Educación, tecnología educativa.

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I
Prologue

In approximately 44 BCE in the middle of a busy schedule, the Roman Senator Cicero wrote a long letter, in the form of an essay, to his son, Marcus, far away in Athens[1]. It was a letter of instruction. Cicero gave Marcus advice on how to conduct himself properly and how to balance the competing claims of expediency and honor. It was a letter that may have been written by any parent. For parents have always engaged in such long distance education. The letter, the telephone call, now email, have been the means by which parents instruct their sons and daughters at long distance. Of course parents have not been the only ones to use these means to instruct others far removed from them in time and distance. Another name for letter is epistle, and the "Epistles to the Corinthians" claims attention as a famous set of instructions at long distance and now over time. And since the 15th century perhaps the most expedient mode by which to instruct at long distance has been the book. A marvelous concise package of information, the book can't be beat for its flexibility and portability. It can be studied within the privacy of one's study or read while sprawled at the beach in the Virgin Islands. Now that supremacy in long distance education may no longer be the case.

New means of transporting information provide new opportunities. Before, print provided the handiest conveyance by which to carry a message. Now, increasingly electrons provide the handiest transport. Those who educate have seized this transport, and they convey information by various devices. Radio, video, and internet increasingly become the tools by which to present information at long distance. With those tools, the same subject matter can be delivered to the same audience at the same time or to different audiences at different times. As a category name for a set of communication tools for a remote audience, Long Distance Education represents the opportunity to reach more people more quickly.

But in celebrating these new opportunities too many educators confound instruction with the means of delivering that instruction. Whatever innovation is occurring here, occurs in the technology of telecommunication not in the technology of instruction. The primary model of instruction remains the lecture model. Not much has changed in that model since students faced their professors in short distance education at the University of Bologna in the 11th century. Modern means of communicating deliver a superannuated way of instructing.

The problems of mass education, with its attendant problems of meeting economic and social needs, drive the emphasis on delivery systems. Huge numbers of people clamor for a higher education, and the more reached at one time, the cheaper the unit of instructional effort. But more people given an opportunity to be taught does not mean that more are taught. As educators, what is of importance to us, or should be, is pedagogical technology; not whether instruction is delivered by mail or radio or video or computer or mobile device.

Regardless of the delivery mode and regardless of the number to whom that mode delivers a given content, what is required is an instructional effect. Furthermore, we require that effect at the level of the individual student, not just an average effect at an aggregate level. In other disciplines and with other products, would we accept the notion of a superior technology exclusively on the basis that one group on the average does better than another? Would we be happy with our new car, often in the repair shop, if we know that on the average the maker of our car produces a better automobile than its competitors? It is the performance of our car that matters for us, not the performance of the average car, even the average superior car. Or if we were ill would we rest content taking a medicine which the physician reassures us on the average kills most of the bacteria harming us, and sometimes it will destroy all of them, and sometimes, unfortunately, kill none. As a patient we look for a medical technology that can address our individual medical problems, and not just hope for a happy result in a lottery of actuarial outcomes. With our instructional technology, we cannot, and should not, rest satisfied with producing student repertoires whose average group level may be superior but which reflects differing outcomes of quality, including those students deemed as failures or of poor quality or even of average quality. These outcomes reflect the delivery impact on students who can teach themselves well or poorly, and thus represent the intersect of delivery mode and opportunity. But if instruction means anything, it means more than opportunity. An effective instructional technology produces change in any specified repertoire of any given student. It is not left up to a student to get knowledgeable from ignorance any more than a medical technology leaves it up to a patient to get well from illness. Of course, both student and patient must play an active role, but so must the doctor and the educator. As always, the issue is how can we, as educators, do it? How do we produce a pedagogical effect? Clearly, it is not simply by showing or talking at long distance with modern telecommunications technology.

II
Behavioral Variability

To achieve an effective instructional technology, we must understand what our central instructional problem is—that central instructional problem is not mass education. Our primary instructional problem is the variability of students;

[1] It may be more accurate to say that it was an essay in the form of letters. But as Griffin and Atkins state, "Cicero planned the work with his son in mind." Introduction, p. xvi, in Cicero, On Duties (44BCE/1991).

more exactly, the variability of the student behavior we encounter.

Behavioral variability is what makes it so difficult to design instruction that fits any and all students—whether a great many students, or a few students, or one student. Even with one student, if we had a particular lecture we would change its tempo and rhythm and examples to adjust to the rate and manner in which that student best understands. With a greater number of students, the complexity and type in variability of action becomes more extensive. Even those repertoires in a delimited domain of knowledge—such as art, dentistry, linguistics, music, or zoology—vary considerably.

What makes the challenge of this variability of repertoire so difficult for any instructional designer are the two necessary components of any effective instructional arrangement. Each component's importance launches many battles over its place in curriculum and instructional design. But the battles ensue because the rhetoric which promote these necessary elements leaves no conceptual space that describes them accurately. One component is a social necessity. The other component is an instructional necessity. These components are: (1) the social necessity to make student repertoires more alike as well as more different; and (2) the instructional necessity for students to contact a subject matter directly as well through what others write or say about it.

The second component has become a cliched bromide for any instructional system: Students should experience the subject matter directly. Like most feel-good platitudes, it is more easily advocated than achieved. Students in higher education rarely contact the subject matter they are attempting to learn. They read about it. They hear about it. They see pictures or view videos about it. Thus, most of what students learn is what others have learned about physics or art or history or biology or behaviorology or any other domain of knowledge. Student actions are governed by the verbal behavior of their teachers, either in person or delivered by book, by video, by computer. Sitting in their homes a hundred or more kilometers away students watch on any convenient mobile device the lecturer apply an electric current to a frog's muscle and explain the reflex that ensues. Such a practice has its benefits. To find out what others know about the world saves time and avoids mistakes. Transmitting accumulated knowledge promotes efficiency of conduct. But simply knowing what others know narrows the scope of alternative actions beyond those learned. In contrast, as events interact with any given student's personal history, those events array themselves as considerably more complex than what can be said about them. For any instructional system, teachers must design the teaching effect. Students must not only know about a subject matter, they must know from it. The subject matter itself must govern in good part how they behave towards it. Instead of simply reading about the principles of learning, students should conduct experiments in which they see those principles in action. A number of instructional techniques with their own pet names, for example the Discovery Method, address the concern that students come under direct control of a subject matter. It is not a new concern: "We see men of experience succeeding more than those who have theory without experience. The reason for this is that experience is knowledge of particulars" is how it was stated some time back by Aristotle (p. 5, 350BCE/1991)[2]. Despite the long-held concern and its enthusiastic touting under whatever label, most courses in higher education delivered by long distance neglect direct contact with a subject matter.

If the second component is cliched, the first is closeted. It is hidden, perhaps better obscured, behind the barrage of words between those that urge methods to unlock the potential of every student and those that promote methods to ensure a basic skill set for any student. Both are correct. Both miss the point. The issue is that of variability.

In the comparison of repertoires, instructional systems must both narrow and expand the variability of the repertoires of the students. First, these repertoires must all reflect what a society has learned from its past. Any educational system carries forth the accumulated wisdom (or what passes as such) of its culture. The hard earned knowledge, whether of ethics or mathematics, must now be taught and become part of the working repertoire of every student. In multiplying powers (such as X^2 times X^3) all students—whatever their ethnicity, whatever their religion, whatever their society, whatever their country—must add their exponents, and in viewing a painting by Goya all students must identify it as his painting, and so on through any of a number of subject matters. All students must perform identically. The variability of their repertoires converge to an identical outcome. The tests of any instructor display this working principle, for to mark a student wrong on an answer asserts that that student's action deviated from the performance template against which the instructor matches all student answers. At the same time, however, any society faces a complex present and an uncertain future, with no fixed answers. If a new generation were all to behave the same way, that would prepare them for only one

[2] In his statement Aristotle anticipates—or perhaps better, adumbrates—the distinction between actions governed by their direct contact with events or by what is said about those events. Over time, others have also called attention to this difference in a variety of ways, for example, the respective advantages of "book learning" versus "street learning". Skinner addresses this matter as a difference between contingency-shaped and rule-governed behavior (1969). But both language and events express their control through contingency shaping and contingency governance. (For a more complete analysis, see Vargas, E. A. [1988].)

of any number of possible futures, and one, moreover, that simply resembled the past. Therefore, variability in student repertoires is called for, and instructional systems must shape repertoires to diverge from each other.

Student repertoires can simultaneously be diverged and converged only by designing an instructional system to achieve performance objectives within three domains of repertoire: that of knowing, that of solving, and that of creating. In the knowledge domain only one answer is correct within a particular arena of information. In Euclidian geometry the shortest distance between two points is a straight line; in Riemannian geometry it is not. Whether learning about religion or science, transmitters of specific cultural knowledge require the convergence to identity of all student actions. In the problem-solving domain, both convergence and divergence occur. Well-known and effective algorithms are performed alike, whether carried out by man or machine. No matter who uses it, a specific algorithm solves all quadratic equations with the same procedure. Other problem solving techniques are not so mechanical or so easily describable. But their practice brings with them a vast variety of problem solving activities. These techniques involve teaching students how to manipulate one portion of their own repertoire by another so that a solution is made possible. In the creativity domain, by definition the greatest variability occurs. The instructional aim here is to have students engage in actions unlike those of any other student or even those from whom the students learn. Divergence within any sphere of knowledge is sought. Teaching creative actions requires that students learn how to use their own history when dealing with a subject matter. It is the interaction between this history, unlike that of any other person's, with whatever subject is at issue, that produces a unique product.

Another source of behavioral variability in the instructional setting stems from teaching activities. The variability of subject matters is not the issue. Of course, subject matters do and will vary. Instead we address the variability of teaching actions, especially the possibility of their changing, and what that implies for the improvement of teaching technology over time. Any technology that improves over time shows immense changes. One has only to think of that first shy flight of 13 seconds at Kitty Hawk and compare that performance with jet aircraft circling the globe; or consider that the first noisy receivers of radio waves now display the fine-grained pictures of television monitors; or note that we carry more computing power in our handheld computers than previously available in a huge array of vacuum tubes. Compare these changes to comparable radical changes of our pedagogical technology. "What radical changes?" one may ask. Exactly. But this stasis in the technology of instruction cannot be solved by simply blaming those who instruct. We must look at the conditions that promote innovations that improve a technology. As with prior innovative change, these conditions demand a point-to-point contact between the innovator's behavior, the teacher in this case, and detailed changes in the element upon which innovation occurs, the student's behavior in this case. Such particulate interaction is not possible in the Lecture Model.

III
The Lecture Model

The Lecture Model cannot attend to variability in the behavior of student and teacher. The teachers' behaviors are governed more by the content of their subject matter than by the actions of their students. We would instantly recognize the university of the 11th century for it would resemble the current one: content experts, regardless of their differences as teachers, still organized in colleges and departments thematically set-up by subject matters; still in charge of so-called "courses"; still delivering their talking and writing by whatever modes are available; and still sending the same message on any one occasion to a gathered aggregate of students; and these students, regardless of their differences as learners, still proceeding in lock step through the phases of their courses. Today anyone could wander through the halls of any university, peek into any classroom, and routinely not see much that would differ in any significant fashion from what one experienced as an undergraduate, and from what any undergraduate experienced centuries ago. No change occurs in teaching actions because what occurs is presenting actions. The Lecture Model features presenters.

With its emphasis on content and presentation, the Lecture Model gets in the way of pedagogical progress in both long and short distance education. No radical innovation occurs. In twenty to forty years from now will instruction still be business as usual; and still produce the same lousy results as usual? The answer is obvious: it will. It will, unless we move out of our current and long standing instructional pedagogy, and move away from the organizational structure that supports it. We must not simply borrow from mass communication technologies the means to disseminate more widely the pedagogical technique already engaged—persistently so for centuries. We must provide a means by which continuously to transform those instructional practices.

Unfortunately, long distance education efforts operate within the Lecture Model, its usual organizational supports, and with the type of personnel necessary for it. It results in a huge downer. The Lecture Model and the institutional arrangements built around it constrain what can be done with new teaching technologies, those present and those forthcoming. The traditional pedagogical technology and the traditional university structure prevent the solution of the core educational problem: achieving high mastery with all students while yet dealing with the enormous variability they bring to the instructional setting. The problem of long distance education is the problem of education at any distance.

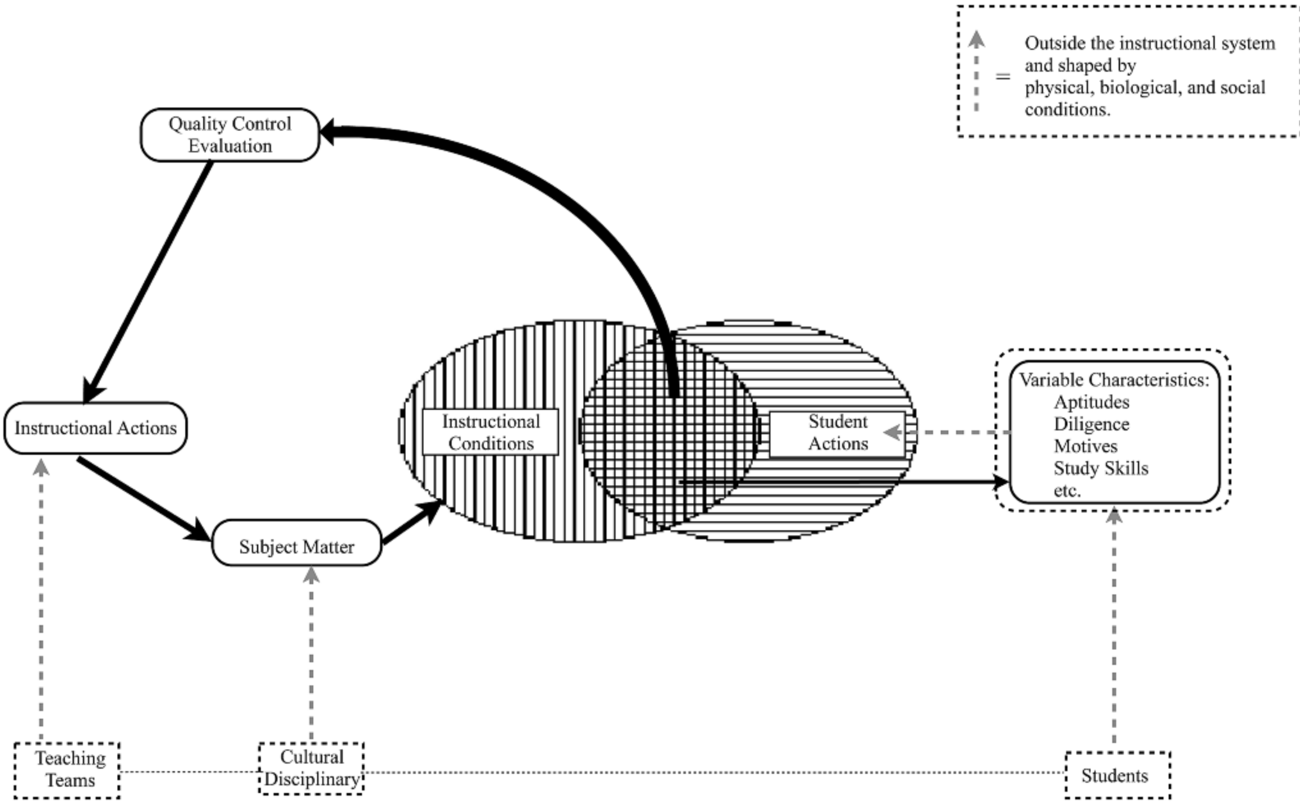

Figure 1. The Quality Assurance Technology of Instruction.

IV
The Triad Model of Education[3]

Innovation at the tool-delivery level, and even at the instructional level, is not sufficient. A sufficient, and required, solution can only result if innovation takes place at three levels of the educational enterprise: its pedagogical technology, its division of labor, and its organizational structure.

Pedagogical Technology

To transform continuously our pedagogical technology requires operating with a system of instruction in which we pinpoint each learning action and through which we account for the effect of every instructional effort. Such thorough effort requires detailed feedback. This feedback provides the information to improve the actions both of those teaching and of those learning. But this feedback does not consist of the laggard feedback of traditional examinations in traditional teaching arrangements. We do not wait until students finish with instruction to then guess why they may have performed as they did. We discover the effect of our instructional arrangements as they occur. The feedback engenders a cybernetic system of instruction.

Students contact our instructional arrangements. Aspects of their repertoires interact with these arrangements. The latter affect student learning actions. In turn, these learning actions affect the teaching actions of those designing the instructional arrangements. Systematic feedback on reciprocal changes in student and instructor repertoires provides the basis by which we redesign the instructional system in a desired direction at a specified standard. Particular and specific information tells where to improve, what to improve, and how to improve. Instruction is made a precise endeavor; innovation an inevitable outcome.

The cybernetic system envisaged is simple in conception, but complex in reality. It must take into account the feedback of thousands of varying actions from each student. These thousands of actions multiply across many students. Such a multitude of actions occurs across the differing domains of repertoires—knowing, solving, and creating. The interaction of many actions and differing domains require dissimilar evaluation instruments. Within each repertoire domain, these dissimilar evaluation instruments must take into account the impact of differing modes of delivery interacting with the

[3] For a more in-depth discussion of what is by necessity a brief overview of the Triad Model of Education, see Vargas, E. A. (2004, 2007).

diverging learning characteristics of each student. Given absolute standards, the assessment must further consider not only the quality of performances against those standards but also the rate at which these performances were occurring[4]. At the same time, at the system level, the cost of alternative instructional technologies must be assessed with respect to their effect. Through this hierarchy of interactional data, from individual performance to system cost, we then redesign those modules of the instructional system most in need of improvement. So that over time any instructional system moves from "biplane to jetliner" and instructing becomes a continuous flow of tiny to tremendous innovations.

Division of Labor

No one person could handle such a teaching effort. That person would have neither the expertise nor the time to handle the demands from the diversity of tasks necessitated by a cybernetic system of individualized instruction.

So what kinds of teachers would we need to put such a pedagogical technology in place? We need an expert in instructional design; someone who can take the content of any subject matter and design learning activities and motivational contingencies so that all students will master that subject matter, solve effectively with it, and create from it. We also need an expert in the modalities of instruction. Each of the delivery modalities requires its own type of expertise—computer, field work, multimedia, small group, video, and so on. For a given delivery mode, such application of modality competence requires time to design, construct, and produce instructional content. It takes time and skill to write programs for computers, scripts for a radio production, and frames for a multimedia presentation. Another necessary expert is one in management, primarily logistics, for tracking the interacting web of social and instructional connections since students access the instructional system at their own convenience and progress at their own pace with a variety of delivery modes at a number of different sites at differing times and dates. For example, when a half dozen students or so pass the modules on genetics and on social policy, only then would they go to a small group session where they might discuss with philosophers and biologists and public officials the ethical implications of genetic engineering. The logistics time frame for instruction changes. Since all students must achieve mastery, the distinction among them will not be in what they know but in the time taken to achieve that mastery. How well and how fast they achieve mastery depends on singular pedagogical technologies impacted by the interactions with diverse properties of student characteristics. In addition, the analysis of the detailed data of those interactions needs a full-time evaluation expert. Based on that evaluation, new teaching techniques or their refinements ensue. And, of course, there is not only the how of instruction and its means, but also the what. A content expert must specify what the student is to master, solve, and create.

Combining divergent expertise with the torrential stream of feedback provides the organizational transport through which to transform current pedagogical practices. Only a team of diverse expertise can take advantage of a huge amount of precise feedback. The benefits of precision feedback are obvious. Wasteful and ineffective practices are dropped. Effective ones are kept and improved. These operations begin to be combined to give a qualitatively different instructional system than the one from which they evolved. But for such a consequence to follow calls for a diversity of practices. The greater the diversity of instructional applications the better. Instructional systems designed by a number of people reflect their combined intellectual outlooks. The greater the differences in learning theory outlooks and preferences in pedagogical techniques the better. Within and between instructional system teams, instructional experts may favor behaviorological or psychological or developmental approaches. They may wish to try out PSI, or PI, or PT techniques, or other acronymic favorites. All should be and can be attempted. Accountability feedback will select those that work best. Over time, feedback arrangements will transform current technologies into radically different ones. The power of instructional systems teams is not only the power of their combined talents, but the power to bring to bear their members' distinctive outlooks on instructional innovation.

Organizational Structure

A mistake is made in thinking of innovation at only one level, solely that of technology. A radical transformation in how we do something requires an equally radical transformation in how we organize to do that something. A new technology requires its own division of labor, and a new division of labor requires its own organizational arrangements. The operation of instructional systems teams calls for a radical restructuring of the university.

The organizational structure of the university must split into an instructing and researching faculty. Full time instructional faculty would be organized into instructional systems teams. These teams would be housed in Pedagogic Centers. Full-time research faculty would be organized as research teams housed in Research Centers. The two faculties would interact, and share joint appointments as occasion,

[4] The best place to start to learn about the use of rate in assessing learning and teaching performances is Vargas, J. S. (2009), especially chapters 5 and 6. Ogden R. Lindsley (1991) has been the foremost proponent of what he termed "Precision Teaching", the utilization of rate in instruction. His article is a good introduction to Precision Teaching and the science from which it derived.

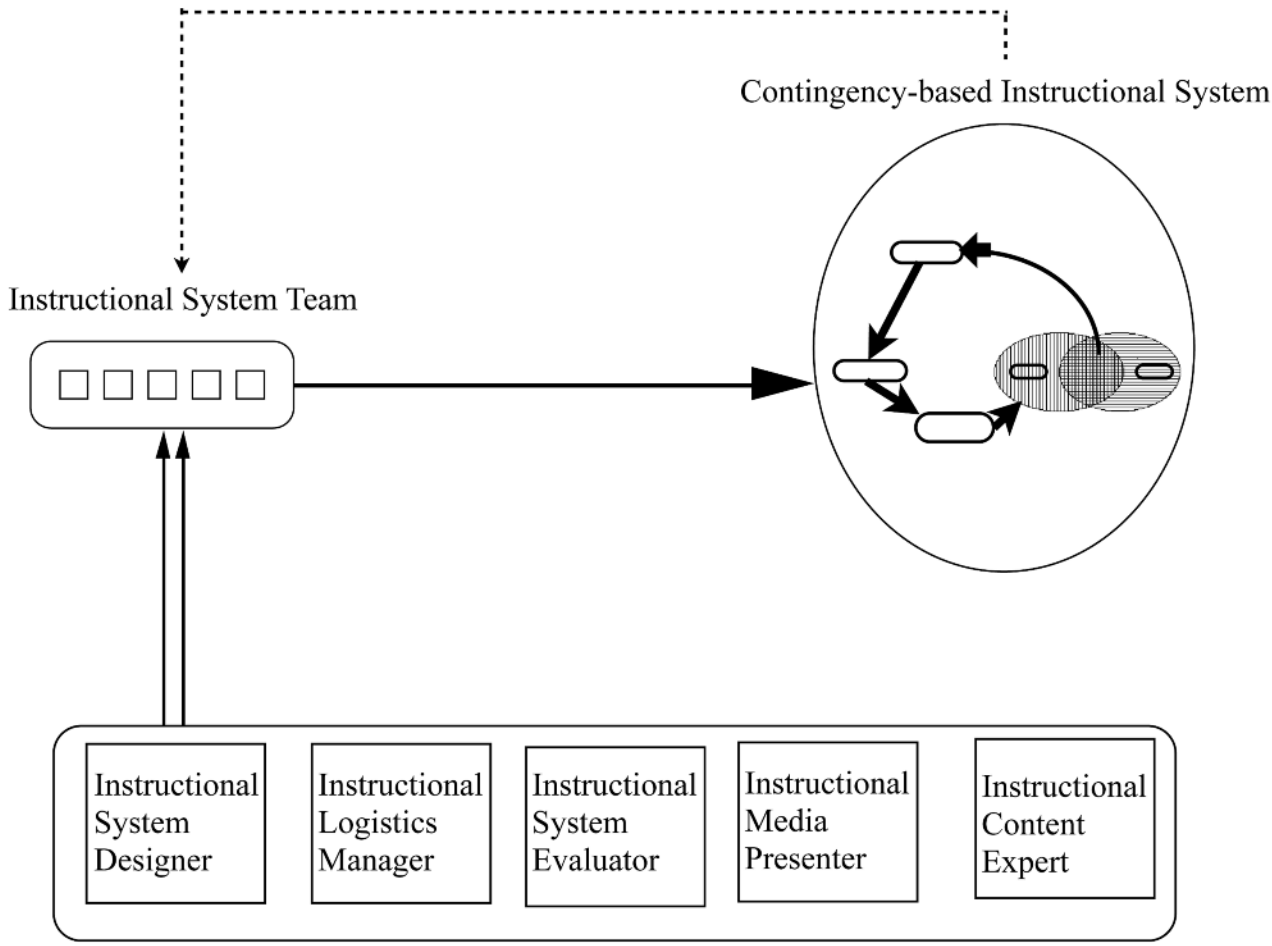

Figure 2. Division of Labor: Instructional Systems Team.

desire, and opportunity permitted. Members of the Instructional Systems Teams might wish, from time to time, to investigate basic theoretical issues in instructional theory. Members of Research Teams might wish to join, on some sort of temporary basis, an Instructional Systems Team so they could contribute the latest findings from their disciplinary area to the university's educational programs. In general, whether in instruction or in research, faculty members would work at what they prefer to do and do best.

The organizational implication seems difficult to grasp or, perhaps more accurately, to accept for sweeping changes would be involved. At the undergraduate level of university operation, there would no longer be a College of Arts & Sciences; there would no longer be a College of Education; there would no longer be a College of Engineering; and so on. That does not mean that the subject matters represented by these sub-organizational units would cease to be taught. Of course they would still be taught. It does not mean that experts within those intellectual domains would no longer be collectively gathered together. Of course they would gather together. What it means is that the reorganization needed for effective instruction and effective investigation would place those necessary for carrying out these functions in units where those functions would be their primary concerns, and where they would be provided with the proper resources.

V
Conclusion

In using the latest telecommunication modes, our problem is not how to deliver effective instruction at long distance. Our problem is delivering effective instruction at any distance. The increasing teamwork necessitated by the demands of long distance education points to a division of labor required by any instructional task in any setting. And we need to go further. We need to link current telecommunications progress to a pedagogical system that takes advantage of the currently available tools, and even more, that informs engineers what new devices would succeed best in teaching. But we cannot introduce a new instructional model and operate successfully with it within an organizational structure meant to operate with another type of instructional model. The university must do more than merely apparently accommodate recent pedagogical and telecommunication technologies.

We cannot fulfill the promise of long distance education much less that of short distance simply by organizing the educational effort as it always has been organized. A radical innovation in technology requires a radically new division of labor. To some extent many long distance education efforts are evolving into a semblance of an instructional team, with experts in delivery modes, such as television, working with content experts. But to operate as effectively as it could, and even to survive, this innovation in division of labor demands its own form of organizational structure. This final step must occur before distance education and any other of a half-dozen half-achieved instructional innovations succeed. In order for the new instructional pedagogy and its appropriate division of labor to operate properly, the correct organizational structure must be in place.

Evaluating any instructional proposal is simple. For these proposed innovations in both long distance and short distance education, the acid test will be whether more students are taught and taught to high mastery levels. Instead of fewer than half graduating of those who enter, the entire cohort who enter would graduate; instead of less than ten percent on occasion mastering the material, all students across all courses would master the material; instead of an occasional student becoming a creative problem-solver, all would be; and instead of the rare person who teaches all students, all those teaching would be effective. No evidence exists at any university of such a state of affairs. Acronymic slogans rather than actual progress promotes the pretense of pedagogical innovation. Today's slogan is LDE. Yesterday's was PSI. The day before yesterday it was PI. And the day before that was AV. Yet our instructional effectiveness is no greater than yesterday or the day before yesterday or the day before that day.

We can do better. What we need in order to do better is within reach. We educators have known for a long time that: (1) we teach most effectively when we consider the needs and capabilities of each student as an individual; (2) we teach most effectively when we know the immediate results of our current teaching action and when we base our next immediate teaching action on those results; (3) we teach most effectively when we engage all sensory modes of our students; (4) we teach most effectively when students contact a subject matter in a variety of ways, through small groups and computers, through lectures and books, through laboratories and video, through field studies and tutorials, and through the many other settings and tools in which instruction can occur and through which it can be delivered; (5) we teach most effectively when students have the benefits of the best and latest thinking in a given area of knowledge; and (6) we know that we have taught effectively when students can do what they could not do before. To all that we know already we should add: that we teach most effectively when we combine the varying expertise available in and out of the university to operate as instructional teams, and place those teams within an organizational structure that facilitates the fullest use of their capabilities.

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