

fore- word

Bloodletting, Media and Learning

Richard E. Clark

This book by Tom Russell is one of the few rational sources of information about an otherwise irrational and commercialized issue. He provides an abundance of evidence for an elegant, simple and empirically accurate point that has been advanced by a number of researchers in the past 70 years. The point is that no matter who or what is being taught, more than one medium will produce adequate learning results and we must choose the less expensive media or waste limited educational resources. His evidence base for the argument is the hundreds (some say thousands) of media comparison studies produced since the 1920's. Most of these studies comparing the learning benefits of different media have resulted in no significant differences. Yet the research has been largely ignored and disputed by three generations of educators and media specialists. Why?

Robert Heinich, a former professor at Indiana University and a long-time editor of "Audio Visual Communication Review" (now called "Educational Technology Research and Development") viewed this argument as a conflict between separate economic interests. Bob thought that the reason for the dispute could be found in the political and economic conflicts between K-12 classroom educators and university faculty on the one hand, and media advocates, including big media business, on the other hand. He noticed the large number of NSD dissertations and articles submitted to the journal over the years. He also noticed the smaller number of significant difference studies which tended to favor either classroom instruction or newer media, depending on who had designed or conducted the study. He suggested that both educators and media interests had economic, political and personal reasons for a stake in the outcome of comparative research.

Bob was the originator of the "John Henry Effect" in research design. Essentially, the John Henry Effect happens in an experiment where the "threatened comparison group" works harder to teach when they realized that their instruction was being compared with a competing media. Bob argued that many of the NSD (and a few significant) findings in media comparison studies were due to the John Henry Effect. If he was correct, then we could improve learning enormously if we were more motivated to do our best instructional job, no matter what media we are using.

What does it mean when we find "no significant differences" (NSD) in an adequately designed study? In science, NSD is an important finding, as important in every way as statistical significance. In fact, one might argue that one of the main contributions of science is to help us overcome our strong inclination only to accept evidence that confirms our beliefs about the world. In a rational world, a number of NSD findings would eventually lead us to change our views about the learning benefits of any particular medium. If medicine had ignored the NSD results of their research, we would still be arguing about whether bloodletting by leeches or knives was more effective for curing illnesses. While empirical method was primitive at that time, NSD results were ignored and arguments were

advanced about the design of the knife or the way it was held, or about the species of leeches used and the location of the incision. The eventual solution for medicine was to find that bloodletting did not work regardless of the instrument, and so bloodletting was gradually discarded. This is different than the current argument about "managed care" in medicine. Some of those who argue about managed health care suggest that it leads to a serious reduction in the quality and results of patient recovery. The argument Russell advances is that when learning (or health) results are equivalent, we can get equal benefit from all compared providers.

The NSD media finding in studies where adequate learning occurs can be interpreted to mean that compared treatments are equal in their impact on learning. If the amount of learning produced by different media is similar (NSD) but adequate to meet our instructional goals, then all treatments are equally valuable for learning but will usually differ in their cost and convenience. Unlike bloodletting research, students do generally experience enough learning when the underlying design of all compared treatments is adequate. So, education must adopt the less expensive media - provided that learning outcomes are equivalent. Why spend more for instruction if there is a significantly less expensive way to achieve the same result? This is the very reasonable mood of the taxpayers and some of those who make our laws and manage our schools.

Yet, this view may be threatening to those who develop, advocate and sell newer media. I was one of those people 30 years ago when I left a commercial career in media to return to the university for a doctorate in education. I was very clear in my own mind that new media (television at that time) were going to revolutionize education and increase learning benefits for everyone. My own conversion to a different point of view developed gradually after reviewing earlier publications like Tom Russell's. Each of my arguments about the inadequate design of media research and the John Henry Effect and the bias of journal editors was eliminated with study and reflection. I arrived only reluctantly at the

argument I advanced 15 years later, in the 1983 "Journal of Educational Research" article that Tom Russell mentions in his introduction.

Tom Russell's book is a reminder to all of us that our field has not been afflicted with rationality. His contribution to the dialogue has been considerable. He challenges all of us not to continually reinvent the wheel when making this argument. Read the literature that he describes and you will find that most of the arguments being voiced have been thoroughly examined and have not changed the NSD interpretation. Maybe someone reading this book will find a new argument. All of us are open to that eventuality. Those readers who are inclined to find a new point of view are reminded however that new insights happen to the prepared mind.

Progress requires that we move on to new arguments and directions. Perhaps that is why Tom has decided that this will be the last year he publishes the NSD study descriptions. The most promising of those new directions can be found in a study of potential economic benefits from various media. A good example of this effort can be found in a recent article by Tom Cobb (1997) in "ECTR&D" (vol. 45, no. 4). There are benefits to be gained from different media. The benefits are economic. If media researchers and practitioners would only switch their concerns to the economics of instruction, we would discover all manner of important cost contributions from media.

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intro- duction



No Significant Difference

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More than ten years ago I decided to identify studies that would “document” the “fact” that technology improved instruction. I sought comparative studies from all the usual sources plus inquiring of colleagues, reading innumerable articles, and following up on references. I soon discovered that there were very few comparative studies that, in fact, found that there was any measurable benefit to learning attributable to technology, and many of these were offset by studies indicating that technology-based instruction was less educationally effective. A startling finding was that there were/are an enormous number of studies — by far the vast majority of comparative ones — that showed no significant difference, at least in strategic parts of the conclusions. I wondered why “we” are seemingly so unaware of these studies or if they are being ignored because the existence of them in such large numbers tends to negate our claims of “improving” instruction through technology. I started collecting these no significant

difference works and providing this information to all who showed an interest. I have also challenged anyone to create a comparable listing of comparative studies showing that technology was noticeably beneficial. No one I know of has accepted that challenge; I feel certain that some have tried and realized the futility of the search. I did not use any scientific sampling method but instead listed every study found that showed no significant difference. For those who criticize me for not listing favorable studies, I again issue the above-mentioned challenge. The point remains that such studies are practically nonexistent and the very few that do exist are offset by a like number which show negative results for the technology-based instruction. The good news is that these no significant difference studies provide substantial evidence that technology does not denigrate instruction. This fact opens doors to employing technologies to increase efficiencies, circumvent obstacles, bridge distances, and the like. It also allows us to employ cheaper and simpler technologies with assurance that outcomes will be comparable with the more sophisticated and expensive ones as well as conventional teaching/learning methods.

When I cite the overwhelming number of no significant difference findings, I generally leave it to the readers to interpret what those studies mean to them. Some become frustrated and immediately search the listings for any flawed studies because they are convinced that the technologies somehow improve learning. These studies tell me that there is nothing inherent in the technologies that elicits improvements in learning. Having said that, let me reassure you that differences in outcomes can be made more positive by adapting the content to the technology. That is, in going through the process of redesigning a course to adapt the content to the technology, it can be improved. The mere process is where the difference lies.

Tom Russell

Clark (1994) states that:

...if learning occurs as a result of exposure to any media, the learning is caused by the instructional method embedded in the media presentation. Method is the inclusion of one of a number of possible representations of a cognitive process or strategy that is necessary for learning but which students cannot or will not provide for themselves. (p. 26)

...if different media or attributes yield similar learning gains and facilitate achievement of necessary performance criteria, then in a design science or an instructional technology, we must always choose the less expensive way to achieve a learning goal. I must also form out theories around the underlying structural features of the shared properties of the interchangeable variables and not base theory on the irrelevant surface features. (p. 22)

In an article, "Soft Technologies: Instructional and Informational Design Research," in Jonassen (1996), Robert D. Tennyson states:

I agree with Clark and believe that our instructional technology research needs to focus more on processes and less on media. One need only attend conferences fairly regularly to see that our field runs through fads or favorite media in cycles. At the time of this writing, hypermedia and multimedia are popular applications and foci of research. Yet both are simply kinds of media used to support instructional methods. (p. 685)

Some consider these findings encouraging as they can now apply technology with full assurance that they will not likely do harm to the instruction — it will be as good at the other end as it is at the origination site. They are now "free" to proceed with confidence that they will likely do as well as they do in the classroom or with other technologies and can capitalize on the uniquenesses of the technology to, for example, reach new constituencies, save funds, and/or reach some of their students (even those in the classroom) whose learning styles are better suited to the new technology as opposed to a previous one or the classroom. In the paper introducing the first version of this compilation in 1992 (included in the following section) I wrote:

No matter how it is produced, how it is delivered, whether or not it is interactive, low-tech, or high-tech students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts.

At that time, I naively thought that notice would be taken of the then-136 *No Significant Difference* listings as well as that bold statement. I was hopeful that the paper would make an impact and/or create controversy, especially since many were promising to improve learning through technology and most were sure that instruction delivered by technology was inferior. While the recognition the paper received — and continues to receive — is gratifying as well as controversial, it nonetheless seems that it has made far less difference than had been hoped. Now, more than six years later, with the number of citations almost tripled, one continues to hear of the goal of instructional improvement through technology, and that technology-based instruction is at a lower quality than the traditional classroom. Pittman (1997) states:

For those charged with creating programs, the good news is that a wealth of evidence supports the position that distance education programs match conventional, on-campus, face-to-face courses in both rigor and quality of outcomes. The bad news is that in spite of the large number of these studies that are performed and presented, nobody ever seems to notice them. Students, administrators, and faculty continue to act as if they were the first to whom the question of comparative outcomes had ever occurred. (p. 42)

The majority of practitioners still insist on costly, cumbersome, and access-limiting accouterments such as synchronous interactivity, and allude to the common nonsense of the profession. Worst of all is the incessant ignoring and/or outright dismissal of comparative research, seemingly because it constantly produces results counter to the wishes of the "researcher." Instead there are such comments as, "the right questions haven't been asked," "the studies are flawed," and, "there is too little research in this area." The latest technologies to enter the arena are those that are computer based. Will they break the No Significant Difference pattern? It was hoped so, but this book includes more than 40 studies on various aspects of this "new" computer-based instruction that have elicited no significant difference outcomes. In an article, "Cooperation and the Use of Technology," in Jonassen (1996) David W. Johnson and Roger T. Johnson pose two questions with answers:

Does technology effect achievement or is it merely a means of delivering instruction? In a review of research Clark (1983) concluded that technology is merely a means of delivering instruction. Our results support this conclusion. (p. 1037)

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Is the effectiveness of a message separate from the medium? Generally, the research on cognitive development indicates that the same information, presented in other formats (especially nonsocial formats) is only marginally effective in promoting genuine cognitive development (Murray, 1983; Johnson & Johnson, 1989). (p. 1038)

I am most thankful to those who have taken the time to contact me and share with me their appreciation for my efforts. It has been a fascinating and rewarding journey. The interest this work has identified has been both overwhelming and gratifying. I have responded to hundreds of world-wide requests for hard copies and there have been more than 25,000 hits, in just the last six months, on the home page at the University of New Brunswick. To those who have benefitted from electronic or print versions of the material, knowing of those gains has been satisfying. To those who seek and find the "weaknesses" in my presentation, I ask that you disregard those weaknesses to see the big picture. If that is the case, I shall be gratified if I have made a difference, albeit insignificant.

— <http://teleeducation.nb.ca/nosignificantdifference>

A site, <http://tenb.mta.ca/phenom/>, has been established at the University of New Brunswick to provide current updates (citations) for readers to submit "no significant difference" and "significant difference" entries for permanent posting.

original article

The following is a letter from Carol A. Twigg in the NLII Viewpoint—Educational National Learning Infrastructure Initiative and is reprinted by permission of EDUCOM (now EDUCAUSE). The article referred to originally appeared in the October 1992 issue of *Research in Distance Education* published by Athabasca University. While the article was focused on television-based technologies, the conclusions are equally applicable to all technologies. An ever-increasing number of these “no significant difference” results are now being realized by the newest computer-based technologies, and the conclusions stated therein seem to be equally attributable to these “cutting edge” technologies in spite of the growing chorus of claims to the contrary. Many thanks to Carol Twigg for her insightful comments and for consenting to their reproduction in this book.

Who hasn't participated in a discussion about learning and information technology without hearing someone say “We need research” or “We need to prove . . . No one knows.” A recent example of this phenomenon occurred on a listserve whose primary purpose sometimes appears to be to question every possible advance in using technology: “Before we commit ourselves to ‘the virtual classroom’ or even the ‘virtual university,’ I would like to see solid empirical research that shows that undergraduates will learn how to think critically, interact rationally, and develop the cognitive and ethical perspectives that they acquire in a good residential program.” In this 1992 article, Tom Russell asks, “Does anyone ever really read research reports?” It's clear the person who made the foregoing statement doesn't. I must admit I don't. But with Tom keeping tabs on the research on instructional media, I don't have to.

Tom Russell is the authority on the “no significant difference” phenomenon. He has created a compendium of more than 200 relevant citations and excerpts illustrating this phenomenon. His compendium is available on the Web (<http://teleeducation.nb.ca/phenom/>), selections from which are included here. Confirming Richard Clark's meta-analysis of research findings on learning and media, which was

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included in the first *NLJ Viewpoint*. Tom states emphatically, "The fact is that the findings of comparative studies are absolutely conclusive; one can bank on them. No matter how it is produced, how it is delivered, whether or not it is interactive, low-tech or high-tech, students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts even though students would rather be on campus with the instructor if that were a real choice."

Comparative studies have shown that people learn as well from traditional print-based correspondence courses as they do from the most slickly produced and/or interactive telecourses. Tom's article that accompanies the excerpts focuses on instructional television to illustrate the distinction between effective learning and the use of various kinds of technologies. In it, he rightly debunks those who insist on high-cost, slick-production, broadcast-quality interactive television when research has shown that low-cost video systems are equally effective. Tom's emphasis is on providing effective access for students at the lowest possible cost. As he says, "While some traveling to Europe might agree that the best way to go would be on the Concorde, being denied the lower cost options that would still get one there would be unthinkable." This article is characteristic of Tom Russell's work: he is eminently rational in his approach (the antithesis of "don't confuse me with the facts!"), and his attention stays fixed where it should be—on effective learning rather than on technology.

Carol A. Twigg

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Television's Indelible Impact on Distance Education: What We Should Have Learned from Comparative Research by Thomas L. Russell

Does anyone ever really read research reports on instructional television? It does not seem so, unless it is to look for an occasional tidbit that might be construed as proof to support what was intended to be done all along. Another reason for reading these reports might be to condemn the now totally predictable "no significant difference" results, and declare that too many individuals read these documents looking for the question that fits the answer already "known"—not unlike Johnny Carson's Carnac.

There has been so much research on instructional television in all of its manifestations—slickly produced, candid classroom, telecourses, interactive, ITFS, videotape, satellite—at all levels and all over the United States that it seems incredible that there is such a high level of ignorance (or is it denial?) of the results. Of course, there are a few contradictions, but there can be a high degree of confidence in drawing firm conclusions from voluminous studies. The fact is that the findings of comparative studies are absolutely conclusive; one can bank on them. No matter how it is produced, how it is delivered, whether or not it is interactive, low tech or high tech, students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts even though students would rather be on campus with the instructor if that were a real choice.

It is also true that many faculty are reluctant to participate on a voluntary basis and will be intimidated by the technology. Often that intimidation will manifest itself in an "uncomfortable" performance for those who do participate. Further, it is abundantly clear that faculty and administration tend to feel that the quality of the instruction for the distance student is inferior to that given to the on-campus, face-to-face student.

If one were to accept the preceding premises and design a new television-based delivery system based on these facts, should it look like any of the current high-tech, high-profile, fiber optic, satellite, broadcast-quality, interactive, highly vaunted system? Absolutely not—unless ignoring what should have been learned from comparative studies and experience continues. High-tech systems are vastly more expensive than low-tech ones. Despite the fact that all systems are equally effective, why is it we continue to elect the most costly, cumbersome, teacher-unfriendly technologies? There is at least one system in existence that was established based on previous knowledge (research) available. This system, the VideoClass System, proves that one can learn from research, and can solve specific problems when they are isolated and simplified.

The VideoClass System, an offshoot/improvement of the candid classroom, is alive and well at North Carolina State University. Since research has proven that any delivery system, regardless of (low) cost, has virtually identical (learning) results, the candid classroom approach was significantly modified. Faculty reluctance has been overcome through a totally new, faculty-dominated, nonintimidating, minimally yet significantly changed candid classroom facility along with operational procedures.

Possibly there are other equally successful programs, but, unlike the VideoClass System, they are not likely to garner any real attention since they lack the sex appeal of super-high-tech, cutting-edge systems. Perhaps it is unfair to criticize these very expensive, newsworthy systems as they are, after all, equally effective.

Almost 10 years ago the Review of Educational REsearch stated and documented, "The best current evidence is that media are mere vehicles that deliver instruction but do not influence achievement any more than the truck that delivers our groceries causes changes in nutrition. . . only the content of the vehicle can influence achievement (Clark, 1983; p.445) Yet, our high-tech propensities seem to compel us to embrace the most visible (sophisticated) technologies, which also exacerbated expense, scheduling difficulties, and other limiting factors. It is time for educators to again take control—take it from the gadgeteers and preachers of erroneous common nonsense. It is time to objectively evaluate what research has taught, and to cast off the stifling, disproved yet pervasive myths of broadcasters and technologists who have imposed unnecessary, self-serving constraints.

It would be naive to think that this one article would have any real impact regarding the onrush to employ all available technology, regardless of cost and relative effectiveness, to reach distant learners. After all everyone knows high-tech, interactive, broadcast quality television teaches better. . . everyone may "know" except

those who know about the research. There is no quarrel with the desirability of broadcast quality, and interactivity, but there is an argument against denying potential students who could be taught with lower-cost, equally effective, more flexible options on the grounds that the best way to go would be on the Concorde being denied the lower cost options that would still get one there would be unthinkable. Imagine what might be done for mankind if self-interested, high-tech dreams could be dispensed with, and action taken with equal enthusiasm based on the absolute knowledge available. What might happen if insisting on the disproved broadcast-quality, interactive, commercial-type production, high-tech (satellite/fiber) course development ceased?

In place of this common nonsense try substituting research-based uncommon sense—good classroom teaching (there are still good teachers, and they can be kept that way if they have not been spoiled with common nonsense) and an appropriately designed and operated low-tech system. Heeding research and carefully downsizing the technology it is possible to:

1. lower cost of instructional television by a factor of 100, perhaps 1000
2. increase course offerings by a comparable number
3. attract, by a similar factor, more volunteer instructors
4. fulfill many more educational needs of the community
5. serve very small as well as large publics
6. respond very quickly with finished, readily updated distance instruction
7. under certain conditions where revenues (tuition) can be generated, provide self-supporting, even profitable, operations.

All this and more could be achieved with research-based confidence; students will learn as well in both the classroom or at a distant site.

It is known, unequivocally, what makes the defensible sense and that which is nonsense. Unfortunately, it seems to have been turned around, and the headlong rush is toward high-tech, interactive systems based entirely on common nonsense while the uncommon sense of low-tech, e.g. the VideoClass System, is completely overlooked.

At one time accountability was an education buzzword. Comparative studies also show that people learn as well from traditional, print-based correspondence courses as they do from the most slickly produced and/or interactive telecourses. Where is the accountability with the knowledge that today's high-tech systems are no more effective than low-tech alternatives such as correspondence courses or the VideoClass System?

Is it still necessary to have conventional television producers and systems? Yes, but their role needs to be that of producers of programming that is useful within the classroom and, therefore, useful in low-tech video systems. At the same time, a new breed of "producer" would not be overly interested in technology but in how to employ the components of the media in the least expensive, demonstratively (research-based) most effective manner to meet the needs of the students.

It should not be a surprise, when the television producer/specialist and other technology-oriented staff are asked for their reaction to these research findings, that they strongly reject all these findings and insist these voluminous comparative studies are erroneous, or at least, not applicable in their situation. This problem is exacerbated by the propensity on the part of the administration and faculty to be predisposed to believe in the necessity for slick production, broadcast quality, and interactivity.

It is folly to disagree with those who say that it is time to stop asking questions about instructional television's effectiveness. It works. Research tells us that it does not improve learning, but it can surely do as well. Here are a few questions researchers should consider:

1. Why do students learn equally well via means such as classroom, correspondence, VideoClass Systems, PBS, audiotape, other?
2. Why are empirical research results ignored to the detriment of constituencies?
3. Why do professional educators embrace high-cost technologies when low-cost technologies work as well?
4. How can administration and faculty—despite research results—perceive that instructional television, especially without interaction, is inferior?
5. Why does interactivity achieve no better results in learning when individual students and teachers believe that it does?
6. How can technology-based distance student drop-out rates be improved?

If one day the lessons of the existing voluminous research were to be accepted, the promise to improve education with the instructional technology would cease, and the proven fact that it can be delivered with the same quality as classroom instruction would be cause for rejoicing. When the day comes that increased sophistication of technologies is shown conclusively to improve learning, then and only then should the promise be restated.

"...**no differences** in test scores of college classroom and correspondence study students enrolled in the same subjects."

"[Results of this study were very similar to Crump 1928 and showed]...**no differences** in test scores of college classroom and correspondence study students enrolled in the same subjects..."

"One group saw the speaker, and the other group heard him from another room [on a loud speaker]. The direct group performed better, but later tests showed that the means were **not significantly different**."

"In all but two comparisons, correspondence study students performed **as well as or better than** their classroom counterparts and in the two cases which were the exception the differences were not significant."

"...a comparison in tests taken after a week showed **little difference** in methods employed."

"The results, also using the test, showed that phonographic recordings **failed to show any superior effectiveness** in teaching the 'informational' aspects of the lesson."

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