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Review Article

Ensuring Quality Delivery of Science, Engineering, Manufacturing and Technology Education Management in Higher Institutions with Particular Reference to African Region

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Abstract

In order to be effective, the use of technology in science, engineering, manufacturing and technology education must involve not only the provision of equipment such as computer hardware, software and machineries. Also the human aspects of essential content, engaging presentation, effective pedagogy, appropriate evaluation, and widespread dissemination. Communication and computing provide dynamic tools, placing nearly continuous demands on financial reserves and human resources as equipment and professional training are revised and upgraded. The write up will be limited to how to optimize a proper and effective delivery and monitoring of Science, Engineering and Technology Education Management in higher institution using Africa as a hypothetical example, and other issues in order to define unique perspectives, concerns, and desirable benefits of

educational technology to a broad range, regardless of the rapidity or direction of change offered by exciting and revolutionary new technologies, the true challenge for developing guiding principles and optima delivery and management for their appropriate implementation lies in the inclusion of all students at all types of academic institutions, with secure and tangible links to the public and private sectors. Again, while access for all, coherence in underlying infrastructure, and compliance between the skills taught in school and those necessary in the workplace are fundamental, it is the collective effort of our human capital that will ensure these powerful tools do not instead widen the gap between the haves and the have-nots.

Key words: *Education Management, Quality Delivery of Science, African Region*

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1. Foreword

The provision of appropriate science, engineering and technology education management programs in addition to well-prepared teachers, instructors and facilitators that are capable of ensuring quality and adequate delivery and management of such powerful programs, must become a vital part of the entire educational continuum as we move on in the millennium.

In order to be effective, the delivery and management of concept of science, engineering and technology in higher institution must involve not only the provision of equipment such as computer hardware and software, but also the human aspects of essential content, engaging presentation, effective pedagogy, appropriate evaluation, and widespread dissemination. Communication and computing provide dynamic tools, managing of human element is also very significant placing nearly continuous demands on financial reserves and human resources as equipment and professional training is revised and upgraded. The research will be limited to how to optimize a proper and effective delivery, management and monitoring of Science, Engineering and Technology Education, (SETED) and other issues

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in order to define unique perspectives, concerns, and desirable benefits of ensuring quality delivery and management of SETED courses to a broad spectrum of constituents.

The notion of widespread, uniform delivery, management and access to education is not a trivial problem. As more adults, paraprofessionals, and part-time students utilize the classroom or laboratory to seek skills in the use of generic or specialized technology, we see that the traditional purviews of academe now extend deep into the entire community. Regardless of the rapidity or direction of change offered by exciting and revolutionary new technologies, the true challenge for developing guiding principles and optima delivery and management for their appropriate implementation lies in the inclusion of all students at all types of academic institutions, with secure and tangible links to the public and private sectors. Again, while access for all, coherence in underlying infrastructure, and compliance between the skills taught in school and those necessary in the workplace are fundamental, it is the collective effort of our human capital that will ensure these powerful tools do not instead widen the gulf between the haves and the have-nots. As this vast endeavor is begun, the cross-divisional and multidisciplinary activities will encourage projects that create effective learning environments with the broadest possible access; the question now is how do we ensure quality of the delivery and management of science, engineering and technology education in our higher institutions?

2. Introduction

Early academic education was devoted almost exclusively to delivery of content or "knowledge." The curriculum was finite and was expected to serve the learner for life. Therefore, the criteria for "quality of delivery" were quite limited and could be assessed with two basic questions:

1) Was the instructor a content expert or a manager of content?
2) Could learners demonstrate, through some type of examination, a mastery of the information provided to them by the teacher or the manger?

Based upon the history of formal education described above and the concomitant history of determining "quality" in education, it should not be surprising, then, that today, at the dawn of the 21st century, that we are struggling to uniformly assess quality in educational activities when neither the purpose, the methods, nor the population for whom education is intended today, bear any resemblance to those on which formal education is historically based. Of course, formal education of the 20th century evolved greatly from its roots in the first millennium. Educational delivery methods grew more complex and student populations more diverse. It is only in the last hundred years, however that education has become more "democratized" and thus available to a much broader population, and only in the last 25 years that the expansion of "open" education and "distance" education have truly impacted the availability of formal education to those unlikely or unable to have pursued it in the past.

3. Contemporary Challenges for Ensuring Quality Delivery of Science, Engineering, manufacturing & Technology Education Management in Higher Institution

New educational and training media such as the internet, one and two-way video and other electronic media allow delivery of instruction independently of time and distance, often to populations who otherwise would not benefit from such resources. Moreover, the dissolution of traditional educational hierarchies and other systems designed as much to exclude certain populations as they were to assure "quality of delivery" have opened the higher education to vast new populations. This new paradigm creates great opportunities for both educators and learners in terms of accessibility, flexibility, and in some cases, cost. However, it also creates significant challenges for quality delivery assurance and accreditation. As the joint Statement of the Regional Accrediting Commissions on the Evaluation of Electronically Offered Degree and Certificate Programs suggests, "While these are welcome developments, the new delivery systems test conventional assumptions, raising fresh questions as to the nature and content of an educational experience and the resources required to provide it" (Council of Regional Accrediting Commissions, 2000). This suggestion is almost certainly understated at the just concluded “Senate Committee of Education Summit in Abuja by the Senate Leader David Mark in his eloquent speech to the summit participants, adds that new educational delivery models are "leading us to a very different concept of quality delivery assurance than we've traditionally had -- but I'm not sure what that is" (Olsen, 1999). Mr. Longanecker’s comment reveals the difficulty of matching new realities to old thinking and the fact that even the leading advocate in the quality delivery assurance are struggling to understand the implications of Millennium education for quality delivery assurance.

The explosive growth in the number and diversity of today’s students, and the impact of technology, cross-border issues, politics, economics, language and culture, and the dissolution of traditional educational hierarchies, present challenges for quality of delivery of science and technology education in our higher education settings that were unimaginable just a quarter century ago. Whether we are speaking of corporate training, continuing education, academic courses, or even entire degree programs, the traditional mainstays of quality delivery assurance such as

physical attendance, "contact hours," proctored testing, formal academic credentials for instructors/trainers, library holdings, and other factors are often impractical or simply irrational in today's educational reality. For example, in a hybrid online course there may be little or no relationship between the amount of time a learner is participating and his or her productivity and learning is not accounted for. In this case, the whole notion of attendance becomes moot. Similarly, in many content specific or information technology training delivery, the most effective instructor for the job may not even possess required competence, let alone an advanced degree. Moreover, geographic boundaries no longer apply to educational access. A course offered by a Nigerian university may be taught by an American professor from multiple locations with students domiciled in USA, North America and Europe. Who accredits such a course and based on what criteria? To whom is the Nigerian University accountable and based on what standards? What resources are available for student research? These questions will only become more pressing as new models of distributed delivery and learning take hold on goal 2020

4. New Paradigms for Quality Delivery Management of Science and Technology Education Courses

As a result of the challenges mentioned in this paper, many traditional academic and professional accrediting bodies are struggling with sometimes blatant mismatches between traditional delivery paradigms of science and technology education in our higher education and new educational delivery realities. It may be that the traditional delivery paradigms of science and technology education in our higher education bodies are not, in fact, the most appropriate entities for developing new, more relevant quality delivery paradigms. For example, Marshall Smith, a former Deputy Secretary for the U.S. Department of Education, believes that the private sector, not government will establish "consumer-based" means of judging quality delivery of science, engineering and technology education courses. "Such entrepreneurs might produce a distance-education version of Amazon.com, which lets buyers read reviews of books the company sells online. Another model…is the online-auction company eBay, which permits buyers to rate sellers of auctioned items" (Carnevale, 2000). Or, it may be that consortia involving instructional providers, learners, professional organizations and the business community are better equipped to develop the criteria for determining quality delivery of science, engineering and technology education courses. In other words, it may make more sense to have "end users," for whom quality is of the utmost importance, play a central role in quality assurance processes of the delivery of science, engineering and technology education in higher institutions. In fact, the very structures, processes, and criteria that govern the work of traditional accreditation bodies may be counterproductive in today's educational reality! It may also be that "accreditation" per say is no longer a productive construct. As long as parties with a common interest can work within a mutually agreeable framework, a dramatic "paradigm shift" away from the traditional accrediting bodies may be not only viable but preferable. Quality Delivery Assurance Initiative at that is being pursued by Osun State University Osogbo is the deployment of Electronics Star board teaching equipments made by Hitachi into the classroom to supplement and standardize the technology delivery within their classroom teaching environment is presently in use by 350,000 institutions and organizations in over 150 countries.

Dr. Guy Bensusan of Northern Arizona University has developed a system whereby buyers (students) would go directly to sellers (instructors) and evaluate their products (classes) before deciding whether or not to register for a course. He terms this process "disintermediation" of educational delivery.

Similarly, as the diversity of student populations continues to increase and the variety of educational opportunities likewise grows at a tremendous rate, it may be time to move the focus in quality assurance toward a predominantly outcomes or product based model which will be tied to how effective is the mode of delivery (as has been the case in business) and away from a focus on the process or the medium (as has been the case with traditional accreditation). In short, it may not even be possible to address 21st century distributed models of education and training with their concomitant political, economic, demographic, cultural, technological, and trans-national challenges via traditional models of quality delivery, assurance or accreditation. Returning to the example earlier in the paper of a course developed and offered by a British university and taught by a Nigerian instructor to students on five continents, even if it were possible to get multiple governments (national and local) and multiple accrediting bodies or ministries of education to agree upon the "legitimacy" of the course, would we want to spend time, energy and money on this process? Moreover, if the learner wants the product and the market values it, does "accreditation" ultimately matter? Does the market itself, in some way, provide a level of quality assurance of the delivery method? Certainly, most of us would not be comfortable assuming that an educational product is a quality product simply because it is valued in the marketplace. Nonetheless, we would be foolish to ignore the fact that ultimately, because of the very nature of learners (or customers) is able to choose from a multitude of educational offerings regardless of what we or anyone else believes about the quality or legitimacy of such products. We would also be naïve not to recognize that education has become a commodity. It can be bought, sold, and transferred just like any other commodity. And educational providers, whether not-for-profit, public, private, or proprietary, are all ultimately bottom-line driven. If an institution's products do not have market value, the institution will not have a market.

Quality of delivery in the new millennium, then, may very likely have more of a business orientation than a traditional educational one—not because "business is better," but because market forces may dictate how educational "products" are delivered and evaluated. Accreditation and quality assurance will likely be different in other ways as well as noted in the table below.

Table. Old versus New Paradigms for Ensuring Quality Delivery and Management of Science, Engineering and Technology in Higher Institution

Old Paradigm	***New Paradigm***
Time as Constant/Learning as Variable	Learning as Constant/Time as Variable
Teacher Credentials	Teacher Skills
Regional/National	International/Global
Static	Dynamic
Single Delivery Model	Distributed Delivery Model
Process	Outcomes
Infrastructure	Services
Teacher/Institution Centered	Learner Centered
Closed	Open
Us versus Them	Collaborative
Quantitative	Qualitative
Prescriptive	Flexible

6. Factors Contributing to the Poor Quality of Delivery & Management of Science and Technology Education in Higher Institution

1. Learning Resources:

   a. Library, Computer facilities, laboratory and other teaching accommodation facilities.
   b. IT infrastructure for learning and teaching and research (IT and internet resources)
   c. Staff educational development/Capacity building

2. Maintenance and Enhancement of quality and standards;

Quantitative data on student achievement. These include

   i. Degree classifications
   ii. Examination failure rates
   iii. Research degree submission rates and
   iv. Tracking or Destination of graduates

3. The image of Science and Technology Education.

   d. Cultural and attitudinal aspects (including gender perspectives)
   e. Issues of quality of education and teaching
   f. Conditions influencing student retention
   g. Labor market perspectives

7. Indices that Dictates Quality of Delivery of Science and Technology Education in Higher Education

Graduates from higher education are expected to be able to think arguments through, to critically assess various points of view, to debate and draw conclusions based on evidence. These types of competencies are often grouped under the acronym HOTS (higher order thinking skills: going beyond the information given, engaging in discovery learning, reasoning, organizing and argumentation; Torff, 2003).

8. What are the Aspects within the Teaching-Learning Environment that can Influence Quality Delivery and Management of Science and Technology Education in Higher Institutions?

8.1 Teachers' Attitude and Practices regarding Teaching

As stated before all teachers take preconceptions and ideas on learning and teaching into the classroom, and implement them in their personal teaching-learning regime (TLR). In addition, teachers often do not take the time to reflect on their own teaching methods and underlying preconceptions. When these teachers are confronted with curriculum reform based on radically different/new scientific insights, they may not be able to implement the desired change without sufficient training and support. For instance, deploying the electronics star board to the classroom without properly training the staffs is dumping a valuable technology in the garbage. Curriculum reform can then be reduced to using new words and concepts for essentially old teaching methods. Research seems to indicate that this is the case, implying that improving teaching cannot be reduced to "developing teaching skills, nor about flexible delivery or about giving students choice.

These are all important characteristics of good teaching, but should not be the primary focus of attention" (Prosser and Trigwell, 1999). Kember (2003) concludes:

"Staff development initiatives and capacity building might be first steps in helping them change, first their perspectives and then their approaches to teaching. However, perspectives or conceptions of teaching are deeply held and firmly rooted beliefs about practice, and these are not easily challenged and changed."

8.2 Academic delivery skills and subject expertise

One of the ironic paradoxes of higher education that staffs are expected to be able to teach at a high level based on their expertise in a particular subject or research area. The implicit influence of their personal teaching and delivery conceptions can be substantial. At lower levels teachers are educated in teaching methods and skills, but this need not mean they are much better off. The entry requirements for teacher training are often not high for science and technology education thus teachers often feel insecure about their own expertise and skills for teaching science and technology subjects. While the previous point addresses perceptions on teaching and touches on fundamental issues regarding teaching in general, it must be well understood that improving teaching skills, delivery methodologies and increasing teacher efficacy and self-confidence is necessary to attain effective delivery of science, engineering and technology education subjects.

There is a body of evidence suggesting that when teachers feel insecure about their own science and technological skills, they are not only reluctant to engage in teaching these subjects even when they are a compulsory part of the curriculum (Wenner, 2001), but they will also revert to more traditional teaching methods aimed at transferring knowledge resulting in lower quality learning outcomes (specific references given in Wenner, 2001, p. 182).

8.3 Learners' attitude and experiences of learning

Learners of all ages take ideas about learning and good teaching with them into the classroom. These ideas can be split into five or six categories (Säljö, 1979; Van Rossum et al, 1985) and similarities have been established with students' epistemological development (Perry, 1970; Van Rossum et al, 1985; Baxter-Magolda, 2003). Research in the early 1980s already demonstrated the clear relationship between students' views on learning, their understanding of significant educational concepts, study approach and learning outcome. They perceived that deep level study approaches led to qualitatively better learning outcomes (Van Rossum and Schenk, 1984; Van Rossum et al, 1985; Chan, 2003; Akinmoladun 2005), in the sense that the outcome is characterized by a deeper understanding of concepts and argumentation. As such, encouraging deep-level study approaches are particularly germane to science and technology education the vehicle for attaining this positive and qualitative are the quality in the delivery SETED courses.

Institutions facing rapidly increasing enrollment demands are starting to expect technology to provide an avenue for expanding capacity – maintaining or increasing access without the costs associated with building new campuses and hiring a proportional number of new faculty members. While the specifics of how this might actually work remain largely a mystery to most policymakers, the expectation that "science, engineering and technology" will help solve this problem is nonetheless real.

In most of the institutions expecting enrollment increases, the majority of the growth will come from populations with relatively low income levels for whom college affordability is a critical issue. Financing growth through substantial tuition increases would undermine access for these citizens. Further, with very few institutions being exempted, the long-expected economic downturn has finally arrived. A very favorable fiscal climate in historical terms over the past five years has allowed institutions to add capacity to their higher education systems without confronting the thorny problems of restructuring or incorporating greater use of technology.

The grim forecast of Harold Hovey's 2000 report for the National Center for Public Policy and Higher Education, Government Spending for Higher Education in the Next Decade: The Battle to Sustain Current Support appears to be coming true. Resources are becoming scarce at precisely the time that higher education is facing the need to invest more, not less, in technology—to provide a quality delivery of education to students, to pursue institutions priorities, and to achieve desired efficiencies.

Higher education institutions look to science, engineering and technology as a way to reconcile expanding demand and constrained resources. The alternatives are not very appealing – either for states or higher education institutions. Further limiting access to higher education, increasing tuition rates far beyond increases in personal income, denying communities the educational infrastructure necessary to support economic growth – none of these alternatives are viable policy options. Just as other industries have looked to science engineering and technology to improve quality and productivity in an increasing competitive environment, states expect that higher education institutions will more

cost-effectively utilize effective delivery method to reach and serve a growing and diverse array of student populations, while maintaining or enhancing the quality of the educational experience. However, this change of focus means that unquestioned assumptions about the costs and benefits of SETED courses will be challenged (as will assumptions about the form and structure of traditional higher education). The focus of policy will increasingly be on the purposes for which the delivery of SETED is being prescribed.

Improving quality of delivery and management in science and technology education in higher education is not only the responsibility of the teacher; the organization must provide sufficient support, for instance, by accepting or sharing responsibility for some of the teacher's many tasks, and so provide them with the opportunity to reflect on and change their teaching methods might require.

9. The Origin of Innovation Trends and Shift in Educational Policy Making and its Effect on Quality of Delivery and Management of SETED Courses

Many teachers often lack the time to keep abreast of educational research because of the pressures of their profession, this need not be true for policymakers. However, it is not always easy to ascertain whether and to what extent policymaking is based on scientific evidence. Within many countries educational policy moves relatively quickly from one innovation to another and educational researchers wishing to evaluate innovations can only wade in after implementation. The inevitable time lag means that conclusions of evaluation studies often come too late to influence political decision-making, and schools and teachers are pressured to embrace yet another 'approved' innovation (Borman et al, 2003). As such it may explain the attitude of teachers towards educational research and educational innovation, which has not been proposed from the bottom up. This attitude will most probably be absent from initiatives originating at school or faculty level, increasing the probability of institutional acceptance and success that also lead to an adverse effect on the delivery of SETED courses in our higher institution.

10. Effect of Perceptions of Learning and Teaching on the Learning Experience and how it Affects the Quality of Delivery and Management of SETED Courses.

Recent study has indicated strong similarities between teachers' conceptions of teaching and learners' conceptions of learning (Van Rossum and Hamer, 2003). The majority of teachers, in particular at the lower levels of education, adhere to the belief that learning means pupils remember what they have been told about the world by the teacher. These teachers unconsciously assume that learners cannot think without first being told how to accomplish this. Inquiry-based learning and related teaching approaches have been implemented from primary level upwards and have demonstrated this assumption to be false (Kite, 2005; Fipse III projects, 1996c). In addition, there are also indications that 36 Teachers in a teacher-centered organization are often expected to be able to allocate resources, form learning communities, read the literature, design courses, develop new curricula, deliver courses, conduct assessments, maintain discipline, respond to students' individual needs and problems, do active research, and participate in other school activities (Branson1998). Many of these activities have their own research communities and body of literature. Formal education can inhibit thinking and reduce the quality of learning and thus the learning outcome (Van Rossum and Hamer, 2003), and that instruction characterized by a low emphasis on HOTS, fostering understanding, intellectual development and personal improvement elicits avoidance and self-handicapping behavior in science pupils (Turner et al, 2002).

11. The Effect of Teaching Environment on the Learning and Delivery Outcome

Throughout most of the western world now, teaching-centered schooling is the norm. It revolves around individual teachers or groups of teachers developing plans, and deciding about methods and assessment: an organizational approach aimed at making students learn. However, learning is not an organizational phenomenon, but an individual one and so this way of teaching may have reached its upper limit with regard to the learning outcome (Branson, 1998). Teaching centered teaching tends to focus on transmitting information or content to the student and there is strong evidence that this type of teaching promotes surface level study approach in students, leading to a relatively poor understanding of the subject (as defined in the SOLO taxonomy by Biggs and Collis, 1982). To evoke learning approach more aimed at HOTS, and to understand and develop learners' conceptions of the material, education needs to make the shift to student centered teaching. Research has shown this type of approach leads to higher quality approaches to learning (Prosser and Trigwell, 1999).

These issues and their relationship with personal epistemology and development are often deemed to be very interesting in a theoretical sense, but the practical implications for educational innovation are delivery often severely underestimated. This is unfortunate, because there is a growing body of evidence that suggests that the views of teachers on teaching and classroom delivery may hamper acceptance and correct implementation of educational innovation. Evidence in other areas, such as organizational change, could indicate that incompatibility between

teachers' and innovators' views on teaching and delivery is central to a lack of satisfactory implementations. Furthermore, incompatibility between teachers' views and those of learners regarding their expectations of teaching and learning inhibits meaningful communication in the classroom, increases dissatisfaction on both sides, and thus impedes high-quality learning based on poor delivery method.

12. Indices of Quality Delivery and Management of Science and Technology in Higher Institutions

12.1 Efficiency in graduating students

a. Number of undergraduate degrees awarded in SETED courses;
b. Number of graduate and professional degrees awarded, including detail on degrees awarded in fields that are high priorities for meeting state workforce needs (mathematics, engineering, technology, computer science and other science fields);
c. Average time-to-degree for undergraduates in SETED courses;
d. Total number and percent of graduating undergraduates who have accumulated excess units required for their degree, as determined by the segments, and the average number of excess units accumulated by these students;
e. Persistence and graduation rates for freshmen and transfer students in SETED courses;
f. Number of undergraduates admitted as freshmen who leave in academic difficulty in SETED courses;
g. Number of undergraduates admitted as transfer students who leave in academic difficulty in SETED courses.

12.2 Ensuring quality delivery and management of science and technology in higher institutions

There is a wide body of literature indicating that particular study approaches lead to a higher Quality of scientific understanding and educational attainment (Biggs and Collis, 1982; van Rossum and Schenk, 1984; Prosser and Trigwell, 1999, etc.). Many of these studies draw the conclusion that teaching students to think should be the real focus of education, while much of the current education system seems to focus on transferring large bodies of knowledge (i.e. facts) without actively promoting understanding of the underlying concepts. Science and Technology Education, particularly at lower levels, are often perceived this way by teachers and students. This perception contradicts the view that science education should foster understanding of scientific approaches and encourage scientific thinking. Many of the researchers contributing to the literature discussed below are former science and technology teachers that have run into this particular teaching paradox. For instance, both Prosser and Trig well are former university physics professors who discovered that traditionally accepted teaching methods did not give the kind of learning outcome they felt was necessary for the students to become scientists or technologist.

Despite the supporting research, little of what is studied and published finds its way into the actual teaching practice. In addition to the restricted exposure to these findings, Branson, among others, implies that "job responsibilities of teachers provide little discretionary time to plan and think. As a consequence, teachers must ignore significant psychological research findings on delivery method, assessment, behavior analysis, learning and cognitive development"

1. Ensuring quality delivery of SETED courses instructional materials must be well designed to be effective. However, it has become clear from the early experience of institutions that doing this effectively means that courses have to be reengineered and infused with modules that give students hands-on experiences with the material being studied.

2. In order to get the scale required to make SETED-based delivery cost-effective, it is often necessary to achieve the collaboration of two or more institutions. By designing SETED courses that can be delivered to multiple sites, providers of instruction can achieve the economies of scale that justify the investment in high quality technology-based instructional media. In the same fashion, economies of scale apply to the providers of telecommunications connections and services.

3. Institution in an attempt to ensure quality delivery of SETED courses must address the question of which assets or functions can most effectively and efficiently be held or conducted centrally instead of being replicated in all or most institutions across the campuses. One specific option that institution will need to consider is when it may be appropriate for one institution to be staffed and funded to provide a service to many across the system. It is likely that institution will find it inappropriate to have each provider replicate all functions in technology-based delivery systems.

4. Experience senior faculty members should be used as content development who actually teach and are capable of mentoring young faculty members in ensuring quality of delivery of SETED course, the instruction function required if economic returns to scale are to be realized—almost demands that peoples' time be used in ways different from that which has historically been the norm of 15hr teaching rules per semester.

Cross section of Students in a vitual delivery classroom

Hitachi electronic stars' board deployed to Osun state University classrooms

Capacity Building of human resources at a University

Training the trainer

Modern Equipment's for Physics with Electronics lab.

Ensuring proper delivery of education, the world over is today driven by technology and these technologies are expensive and often imported as in our case. However, no university worth its name can survive nor make any progress in research, teaching or learning without intensive investment in the acquisition of new and emerging technologies.

In our bid to make a university a centre of excellence in key academic disciplines, most especially science, engineering and technology related disciplines the university must invested heavily on technology to ensure effective and efficient delivery, must provide for teaching and research equipment to departments across various disciplines of the university.

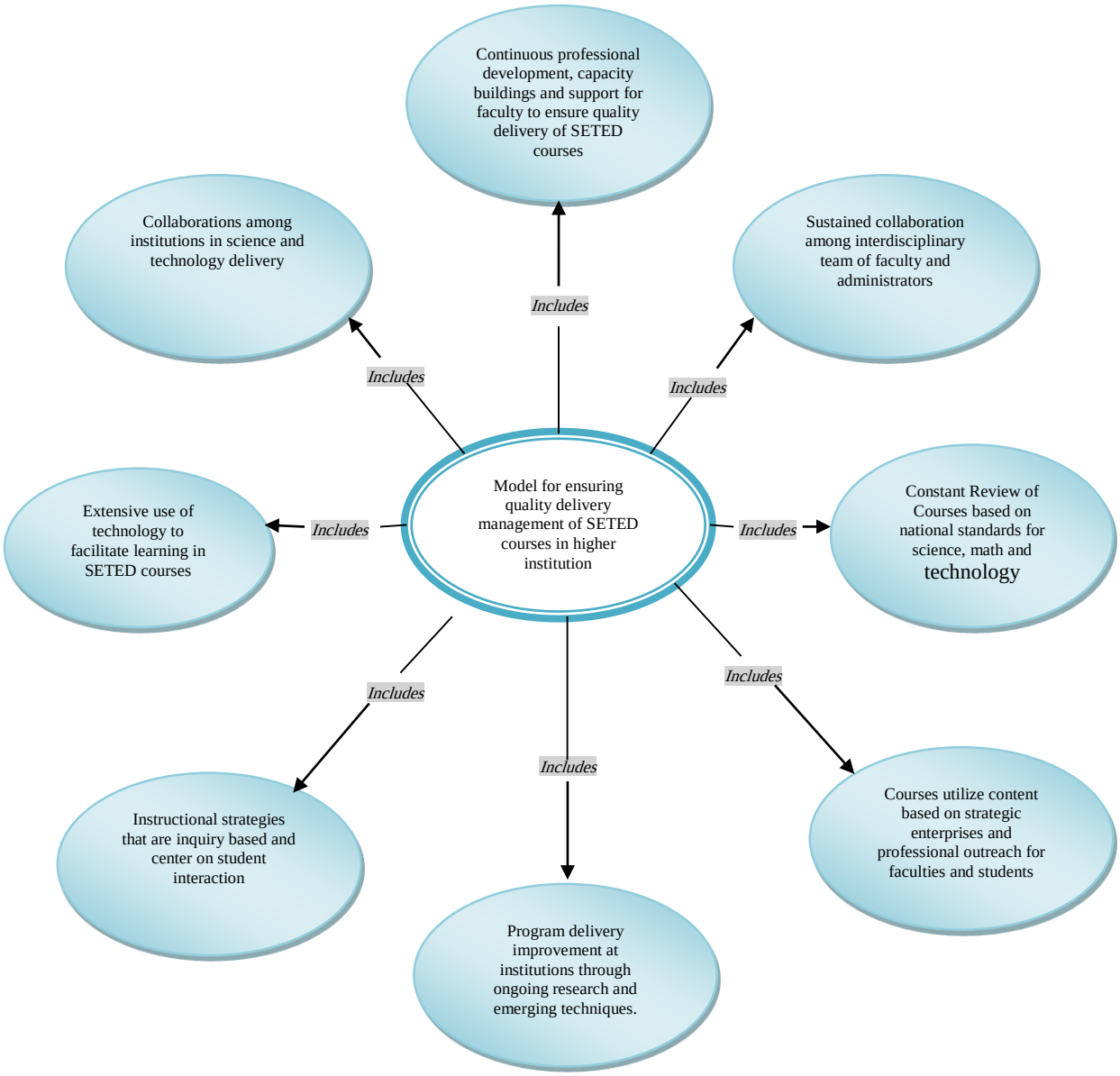

Fig. A. Model for ensuring quality delivery management of SETED courses in higher institution

Conclusions and Recommendations

It is quite clear that ensuring quality of delivery of SETED in higher institutions presents challenges that were unimaginable just a quarter century ago. Method of delivery of SETED courses in particular, requires that we abandon traditional indicators of "quality" such as "contact hours," "library holdings," and "physical attendance" among others in favor of more meaningful technological measures. For example, if the value of attendance has been high quality interaction among students and between students and instructors, then the indicator of quality today should be interaction, *not* attendance. Likewise, if the rationale for requiring certain credentials of instructors, e.g., an advanced degree, was to establish "expertise" in a subject, then in today's educational environment, the indicator of quality should be instructor expertise, *not* a specific academic credential. How do we achieve these outcomes-based measures?

First, we must agree upon a set of "universal" attributes or standards for ensuring quality delivery of SETED courses in our higher institutions, methodology of delivery and experience—*not* the means to achieving the standards, but the standards themselves. Moreover, these standards must be applied *independently of educational delivery method*. As we have discovered in the last few

years, educational delivery is evolving faster than existing quality assurance methods. The resulting dissonance is the product of a misguided belief that standards of quality should exist for each type of delivery. Not only is this approach

theoretically flawed, it is, as we have discovered, highly impractical. We must, therefore, focus on what outcomes we desire from ensuring quality delivery of SETED courses, educational experiences and technology competence of SETED lecturers become very significant, not the means by which the teaching are delivered. A point of departure for discussion of *potential* "universal attributes" model for ensuring quality delivery of SETED courses in our higher institutions as stated in Fig. A above.

Lastly without change, higher education policies will unnecessarily delay and obstruct the ability to ensuring quality delivery of SETED courses in higher institutions to respond and adapt to the new environment resulting from the revolution in information technology. With the right kind of changes, however, institutional policy can foster and support the transformation ensuring quality delivery of SETED courses in our higher education systems so public higher education will continue to play a vital role in the economic and social life of nation.

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