

Development of Future Curriculum via Futures Studies

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Observation on best future choices is not something that happens by chance; in fact, it should be carried out through careful planning driven by research. Therefore, observation on future curriculum would also involve in-depth research on future possibilities and their impact. Policy makers and curriculum developers of institutions or even the country should plan ahead not only for 50 years to come but beyond that. Research on the future would provide essential data in shaping the present generation as well as the future generation. Research oriented from future curriculum should be developed based on research findings on the future, including research on trends, events and their respective impact on the targeted learners. Therefore, the researchers will also discuss the aims, definition, basics and importance of future curriculum. The paper also includes discussion about future curriculum for engineering education.

Keywords: curriculum, future curriculum, future forecasting, trends, events, future possibilities, future choices

Introduction

Futures studies is a well advanced and established field dominated mostly by developed countries especially in the US and Europe. This field may be a key factor contributing to the capacity of these countries to stay ahead in society development and nation building compared to other countries in the world. The following evidences clearly indicate the long commitment of these developed countries especially the US towards futures studies; evidences which call for our immediate attention to consider embracing futures studies:

(1) The RAND (Report on a Long-Range Forecasting Study) Corporation, Santa Monica, California, has published findings on futures studies in RAND report since the 1950s (Dalkey & Helmer, 1951);

(2) The establishment of Futures Studies Centres in higher institutions in the US. Among them are Centre for Futures Research, University of Southern California, Los Angeles (Alter, Drobnick, & Enzer, 1982);

(3) Birth of journals on futures such as: (a) *Futures*; (b) *International Journal of Forecasting*; (c) *International Journal of Futures Studies*; and (d) *Technological Forecasting and Social Change and The Futurist*;

(4) The establishment of councils and societies for futures studies in Western countries, such as American Council for the United Nations University, Washington D. C.: Each year, since 2000, the council has published the books *State of the Future* (Glenn & Gordon, 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008) and *World Future Society, Washington D. C.* (Cornish, 1977);

(5) Futures studies by Carswell, Thomas, Petre, Price, and Richards (1999), Dean and West (1999), Friman, Tufvesson, and Woodling (2000), Robson (2001), Vamadore (1991) and Wicklein (1993), and others.

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In fact, since the 1940s, futures studies have been accepted as one of the knowledge disciplines in the US and in several European countries. In 1944, General Arnold ordered a report on future technologies which could be utilized by the US Air Force. Two years later, in 1946, Douglas Aircraft Company initiated The RAND Project to conduct researches on matters related to war among continents (Wikipedia, 2006).

Subsequently, in the 1950s, more and more futures studies were carried out in the States. Among them were the RAND studies by Dalkey and Helmer (1951). They were reported as the earliest ones who developed the Delphi technique in the RAND Corporation (Dalkey & Helmer, 1951; 1963). However, Gordon and Helmer were the first futurist figures to apply the technique (Gordon & Helmer, 1964; Gordon & Hayward, 1968). The application of Delphi technique by Gordon and Helmer (1964) aimed to evaluate the directions of science and technology trends and their impact on society at that time.

According to Wikipedia (2006), Delphi Technique was developed in the RAND Corporation in 1947, which was the era of the Cold War between US and Soviet Union (Russia at present). However, Henson (1980) claimed that Delphi technique was founded in the 1950s by Abraham Kaplan in California, but unfortunately, the technique was kept as confidential for ten years till Gordon and Helmer revealed it when preparing the RAND report.

From 1963 to 1964, Gordon and Helmer (1964) produced the RAND report based on data and evidences of their time. The report forecasted that in the future, about 130 scientific successes would be achieved by America. Most of the forecasts have been a reality now such as the success of the first men who landed on the moon and the possibility of liver transplant in medical field (Longstreet & Shane, 1993; Saedah Siraj, 2005). Forty years earlier, Kahn and Wiener (1967) (Hudson Institute in US established by Herman Kahn in 1961), had listed a hundred innovations which would appear in 2000. Among the forecasts that came true were: (1) Laser for multi-functions; (2) The widespread human organ transplants; (3) Satellites; (4) The use of communication satellites which channels entertainment to homes; (5) Video recorders, pagers and affordable mobile phones; (6) The emergence of 3D television and movie films; (7) Automatic house-cleaner with robots as slaves to human (a reality in high-tech automotive factories); (8) Man will land on the Moon; (9) Touch down on the Moon would initiate more advanced projects (today mankind have succeeded in sending space probes into space to explore the planets, Mars and Pluto); and (10) The existence of settlements under the ocean.

In 1968, Gordon and Hayward published an article about early studies using Cross Impact Matrix Method (Gordon & Hayward, 1968). Later in 1994, Gordon published another article on Cross Impact Analysis under the publication of The United Nations University's Millennium Project Feasibility Study: Phase II (Gordon, 1994). Since the year of 2000 till today, the American Council for The United Nations University has published books on futures studies (Glenn & Gordon, 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008).

What is the more pertinent point to be underscored here is that those forecasts mentioned here did come true today not due to chance or coincidence. It was through dedicated and careful research based on study using research tools like Delphi technique and Cross Impact Analysis that enable the past researchers to successfully plot preferable future and help their countries to plan to reach their desired future which we can observe today.

What Is Futures Studies?

Futures studies is a systematic discipline to study future probabilities within a certain time frame. Apart from the study, analysis is carried out to ascertain how particular situations and environment could be affected

as a result of a policy implementation or action taken by a country (Saedah Siraj, 2005; 2007).

Glenn and Gordon (1996) similarly claimed that research on futures offered from various future disciplines and profession and phenomena which shaped the world, apart from studying how they changed in creating new opportunities, new threats and uncertainties.

The aims of futures studies would be:

- (1) As one of the latest strategies to enable the present society to plan their future;
- (2) To illustrate possibilities and choices about the future to aid policy makers and curriculum developers of institutions and the country to plan for preferred futures (Ayers, 1969);
- (3) To aid policy makers and curriculum developers of institutions and the country to make decisions on:
 - (a) Identifying best preferred futures; and
 - (b) Identifying events which have high probabilities to happen in the future;
- (4) To aid policy makers and curriculum developers of institutions and the country to outline action plans in order to avoid making false assumptions about the future;
- (5) To aid certain parties to state their views and choices about the future (Amara & Salancik, 1971-1972);
- (6) To explain the probability of preferred futures (Bell & Ramirez, 1997).

What Is Future Curriculum?

According to the authors, futures studies are a systematic discipline to study probable futures within a specific time frame. Apart from this, analysis is carried out to investigate how certain situations and environment change as a result of implementation of certain policies and actions in a country (Saedah Siraj, 2005; 2007).

Glenn and Gordon (1996) viewed that researches on the futures provided information from various discipline and professions of the future and phenomena which shaped the world and changed in creating new opportunities, new threats and uncertainties. Amara and Salancik (1971-1972) viewed futures studies as any activities which enriched comprehension of future outcomes as a result from development and choices made today. Longstreet and Shane (1993) stated that future planning did not mean changing what has been decided at the present but to render focus on probabilities and impacts offered in future planning. Snow (1999) on the other hand illustrated the future scenario depends on the decided policies made in the present. Slaughter (1997) stated that although the future could not be forecasted precisely, there were numerous inter-related things such as: (1) Main trends; (2) Changes in main events and processes (some of these processes would ceased to exist); (3) Illustrations of future choices for example scenario planning; and (4) Choices made could be observed such as future strategies.

Definition of Future Curriculum

Curriculum is defined as a design or planning of an institution or country and it is by itself encompasses a wide range of meaning which covers a whole programme that has been planned (Slaughter, 1997). Longstreet and Shane (1993) stressed that futures studies is a study on future society and not a study about the future. Combining these both definitions by Saedah Siraj (2001) on curriculum and Longstreet and Shane (1993) on futures studies resulted in the definition of future curriculum as a design or planning of the whole education programme for future society.

Therefore, future curriculum is a curriculum developed today for tomorrow based on systematic

forecasting. Every aspect in curriculum development consists of aims, content, implementation strategies and form of assessment needs empirical data through research studies which among them utilize Delphi technique or Cross Impact Analysis. The developed curriculum will be used in the education system so that what has been implemented in the education system would have clear direction in resulting better future generation without loss of unnecessary cost, energy and resources.

Foundation of Future Curriculum

The foundation of future curriculum should be understood beforehand, in order to allow a certain change to happen in the future. The foundation would be the crust of future curriculum. It is divided into three basic components as follows.

The Eight Basics (Longstreet & Shane, 1993)

The eight basics adopted from Longstreet and Shane (1993) are as follows:

- (1) Planning of future curriculum is not to change the present;
- (2) The future is a phenomenon subject to changes compared to the present;
- (3) Mankind invents things today and also in the future based on what has been planned;
- (4) Future curriculum planning is organized based on values and beliefs;
- (5) The future curriculum begins in the present time. Therefore, the present is an important foundation for future curriculum;
- (6) The policy of future curriculum focuses on probabilities and impact or outcomes related to planning for better future;
- (7) As addition to each statistical and forecasting analysis, the study of future curriculum and other rational study on forecasting development should be able to be formulized and measured;
- (h) Humanity itself at present could form the criteria of better concept of the future.

The Main Elements

There are two main elements in future curriculum:

- (1) Identify main events with high probabilities to happen in the future-related to education for future society; and forecasting on various analysis dimension which relates to education for future society which includes analysis on socio-economy and politics, human resource, energy sources, agriculture or even military;
- (2) Forecasting (scientific observation of the future supported by data and application of experience) or estimating (an action to anticipate future events beforehand or bypassing current data to form interrelated scenarios) on national and global trends of the future that are related to education for future society and forecasting on various dimension analysis which are related to education for future society, including analysis of socio-economy and politics, human resource, energy sources, agriculture or even military.

Design or Planning

According to the authors, the design of future curriculum should determine clearly the direction of the present curriculum in the aspect of its quality, target of national aims or even development of future generation who possess high intellectual ability, ethical, intelligent and knowledgeable. Due to the fact that human himself/herself is capable of determining significant development in the future, future critical and challenging situation would be better managed, conditionally the future curriculum could be planned appropriately and systematic (Saedah Siraj, 2005).

These three basic components of future curriculum as discussed above (eight-basics, the elements of future curriculum and design or planning of future curriculum) are vital in enabling changes to set foot in the future.

Approaches to Develop Future Curriculum

There are numerous approaches in measuring the future curriculum. Among them were adopted by Cornish (1977), Friman, Tufvesson, and Woodling, (2000), Glenn and Gordon (1996), Klopfenstein (1986), Saedah Siraj (2002b; 2002c; 2005; 2006), Saedah Siraj and Paris Saleh (2003), Schnaars (1989), and Smoker and Groff (2003) as listed below:

- (1) Delphi technique (experts' consensus opinion);
- (2) Cross impact analysis;
- (3) Alternative futures projection;
- (4) Visioning approach;
- (5) Scenario planning;
- (6) Word mapping;
- (7) Linear or classic projection;
- (8) Bibliographic analysis;
- (9) Environmental scanning;
- (10) Trend extrapolations;
- (11) Future scanning and analysis method;
- (12) Historical analogy;
- (13) Technological forecasting;
- (14) Technological impact assessment;
- (15) Future wheels;
- (16) Science fiction;
- (17) Intuition and intuitive forecasting;
- (18) Relevance trees;
- (19) CERT/CPM Analysis (A method for doing complex planning of great numbers of people and subcontractors working on some large projects, such as the space program);
- (20) Short, medium and long-range planning.

The following are a few selected approaches to be described briefly.

Delphi Technique

Delphi technique is an approach to obtain a consensus of experts' opinion about the future without personal influence (Saedah Siraj, 2007; 2006). This technique is also known as Consensus Approach or Inner-Opinions Consensus (thoughts, intuitions and feelings) of a group of selected experts (Donnelly, 2006) or Delphi Polls of Experts (Smoker & Groff, 2003).

According to Linstone and Turoff (1975), Delphi technique should be carried out based on five principles: (1) Privacy: Samples are chosen individually and each sample has no knowledge of the identity of the others in an expert panel; (2) Relationship: Samples only know the responses of the others in the second round when the researcher has conducted the data analysis. Armstrong (1985) explained that relationship among samples does not exist, their opinions are classified but instead their ideas are integrated in the analysis of data; (3) Samples would not face any pressure from any parties or other samples in responding to their questionnaires; (4) Data

would be analyzed statistically; and (5) Data which is given by a sample would be bias-free, allowing the panel of experts to carry out their role to come to a decision or achieve consensus.

The method. Generally, in conducting a research using the Delphi technique, the following procedures will be applied as a guide:

(1) Selection of sample (experts) which is accurate and appropriate to the aim or field of study;

(2) A set of questionnaires will be formulated by the researcher to be distributed to the selected expert panel; the questionnaires should be answered individually by the sample without any pressure or influence by any parties; then the responses to the questionnaires will be collected to be analyzed. This is Delphi Round one;

(3) The results from the questionnaires will be returned to each expert in order to allow them to reevaluate their former responses in comparison to other experts' responses. This would be Delphi Round two;

(4) There would be a possibility for the researcher to extend the research cycle to Delphi Round three or even Delphi Round four before the final process of data is finalized. Conducting the research cycle in this manner would allow the experts to defend their preliminary responses or change their opinions to agree with the majority opinions of other panel members. The researcher should analyze each responses, either in the form of suggestions or rejections in every round to derive to an accurate answer based on the major preferences of the experts, in other words to obtain the experts' consensus.

Advantages. Among the advantages of this technique would be: (1) Enabling the researcher to obtain experts' consensus genuinely as the identity of each expert is kept unknown to the others; (2) Experts' consensus could be obtain without any discrimination, influence or pressure from any parties; (3) Research cycle will be repeated where the data from each Delphi round would be refined through data analysis; (4) Be quick and efficient; (5) Experts are able to express their opinions/views consistent with their field of expertise; and (6) The technique could be employed effectively to elicit opinions on complex issues.

Limitations. Among the limitations of this technique would be: (1) The reliability of the data depends on the expertise, if the researcher failed to identify the correct experts, the research findings would lose their reliabilities; (2) Repetition of the research cycle may bore the sample; (3) Delphi is a technique to forecast the future, therefore reliability loss would result in loss of hope and vision; (4) The small number of experts may not be able to solve all regulations in the issue studied; and (5) Lack of opportunities to solicit responses from the emotional aspect.

Alternative Futures Projection

Alternative futures projection as an approach provides a variety of future possibilities. The complex future is developed through dynamic and creative participation which includes control of future possibilities via scientific measurement (Saedah Siraj, 2002b; 2002c; 2006).

Future Scanning and Analysis Method

Future scanning and analysis method is based on a systematic worldview of the future as oppose to fantasy or irrational viewpoint (Friman et al., 2000). This systematic worldview refers either to individual process or group network process, but not group brain-storming method which is not systematic. Findings from this process are not merely comments which are motivation driven or self-expression, but contain elements which can be evaluated.

This method aimed to develop scenarios which are known as the art of strategic conversation (Friman et al., 2000). The conversation in the group may lead to individual creativity and new strategic thinking. These

creativities and thinking need to be arranged and realized. The main aim of the method is to develop a system based on individual views on the environment or surveying work frame where changes could happen (Friman et al., 2000; Saedah Siraj, 2007).

Environmental Scanning

Glenn and Gordon (2004) stressed that the term “environmental” here did not refer to the physical environment. It referred to the social, politics, technology and economical issues. Today, this method is used by many giant companies and higher institutions worldwide as a part of their planning processes. Analysis of this method involves systematic data collection in external situations, relating to the companies or institution to aid them to understand the current development and social trend, technology, economy and future politics which could bring about impact to the future (Saedah Siraj, 2002b; 2002c; 2005; 2006).

Scenario

According to Kahn and Weiner (1967), the method, Scenario renders focus on cause process and to aid in difficult decisions. Cornish (1977) explained that Scenario is narration of the future. While Schwarz, Svedin, and Wittrock (1982) stated that Scenario has several meanings: (1) It may be used for probability or improbability; (2) It can be used as a hypothesis; (3) Development or situation; and (4) Changes which occurred due to action or responses of several individuals which are needed or not in the development or situation.

The advantages of this method are: (1) Be able to show relationships among trends and events to illustrate accurate futures; (2) Be able to aid in evaluating inner stability of a set of forecasting; and (3) Be able to illustrate future situations which are comprehensible to the public (Martino, 1983).

Importance of Future Curriculum to Learning Institutions and Country

The following are the importance of future curriculum for the nation:

(1) The roles of planners and curriculum designers would be vital in ascertaining the future direction of the education system. However, future (an important element of curriculum) and future forecasting includes data (an important element of future curriculum) are two significant elements in planning or forming the curriculum for an institution or nation. In other words, future curriculum becomes an important element in any planning or curriculum development of an institution or nation;

(2) Forecasting future with data can assist an institution or country to make various preparations including finance, infrastructure and human resource to achieve each of their goals;

(3) Through modification (a key element in future curriculum), additional goals which are related to the institution or the future of a nation will be attainable;

(4) Planners and policy legislator and curriculum implementation experts in future curriculum are the main asset of an institution or country the future generation and its global community;

(5) Research data on future curriculum can provide a balance to push policies or curriculum implementation which could be detrimental to the future and the nation. The data can also provide a curriculum which is able to handle unexpected needs of the current society and for the future by creating educated and broad minded individuals of the younger generation and with that they are hoped to be able to live more comfortably;

(6) Developers and curriculum developers with future curriculum expertise would be able to plan current concepts which are principled on national culture, logic and moral values. This is because these experts (those who have collected future data) possess and are knowledgeable in these matters. In fact, they

are able to analyze the nation's philosophical principles and the need of the current youth, and solve future problems indefinitely;

(7) Planners and curriculum developers with future curriculum background would be more dedicated, competitive and possessing self-identity in confronting challenges and pressing obstacles, including the current erratic characteristics of society, as well as the future needs of the nation;

(8) Planners and curriculum developers with expertise in future curriculum would be able to analyze the principles of the nation's philosophy and the needs of the youths, and also solve future problems indefinitely which include future forecasting of national and global trends. They will also face the crisis of choosing a policy and the goals of future education. Through the futuristic approach, including identifying current trends and forecasting future changes, planners and curriculum designers will no longer face any crises in choosing future policies and educational goals. "Alternatively, problems in education will be the consequence when curriculum policies are not forecasted further through futurism" (Saedah Siraj, 2001).

Futures Studies and Engineering Curriculum

Futures studies is in fact not an alien component in the design and development of curriculum for fields or subjects such as engineering in developed countries. For example, via futures technique, Rowan University of New Jersey decided to integrate biology in the future chemical engineering curriculum as their findings showed that the integration seems to be the future for chemical engineering programs nation and worldwide (Saedah Siraj, 2002a). The integration of biology in the chemical engineering curriculum claimed to help prepare students for careers in food, biotechnology and pharmaceutical industries in the future. On the other hand, Michael and Laurence (2000) in their review of the undergraduate civil engineering curriculum of Georgia Institute of Technology for the future emphasized adoption of a system's perspective for civil and environmental engineering; the incorporation of sustainability, technical communications and professional ethics into the curriculum; the importance of team problem-solving; and the strong emphasis on science in undergraduate education is expected to provide the students with a strong foundation for future success. The role of future engineers is also undertaken to have different roles as leaders of society as is indicated in Purdue University curriculum (Michael & Laurence, 2000) for future engineer as indicated in Figure 1.

It is pertinent that, other countries especially developing countries like Malaysia, should adopt similar initiatives to develop the nation's own design of future curriculum based on research to plan better for future generations, rather than "adopt and adapt" curriculum developed by other countries which may not suit to the needs of this country. Our own future curriculum should be developed rooted from our own present environment, society and culture but not based on other countries' context.

Conclusions

Futures studies is undeniably vital in policy-making and curriculum development of an institution and country as a whole to scaffold a solid action and strategic plan. However, studies based on futures studies throughout the world are still at its infancy stage especially in the areas of education. A more optimistic initiative should be harnessed by involving parties to collect important data related to the future, in order to develop the education system, specifically the curriculum. New policies to face positive and negative possibilities which are forecasted to happen in the future may be introduced especially in the nation goal to become a developed country.

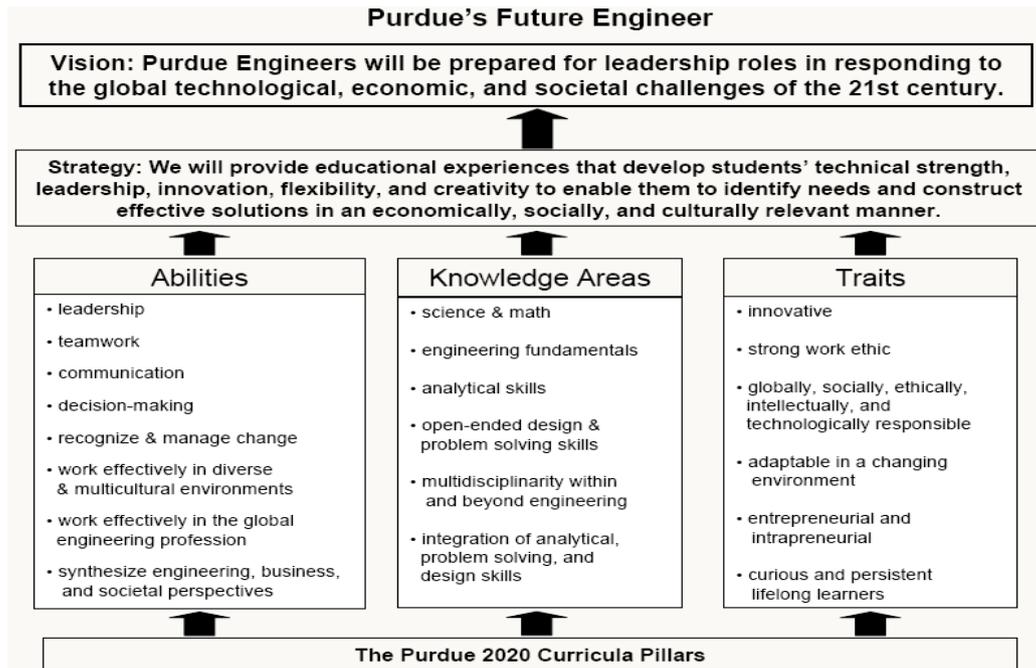


Figure 1. Purdue university 2020 curricula pillar.

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