

# A Perspective from Industry on Characteristics of Life Long Learning

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**Abstract-** An important topic in the ABET accreditation criteria, as well as one generating much discussion in engineering education is that of life long learning. Life long learning is important in any area but engineering and engineering technology graduates particularly need this ability because of the dynamic change caused by technological advancements that affect all they do. What makes a good learner and what are the characteristics one must have to acquire that ability for lifetime? With rigorous disciplines like engineering and technology, how does one keep up and stay excited to learn new things? Are the characteristics of life long learning “caught or taught?” A survey of engineering and engineering technology alumni from Brigham Young University and their supervisors was conducted asking the importance of characteristics such as technical competence, good thinking skills, desire to learn new things, religious faith, ability to work with people, and others, in terms of being a good life long learner. They also rated how well these factors were accomplished in both the general and technical education they received at Brigham Young University. This paper: 1) presents the results of this survey in terms of the impact of technical and general education on being good life long learners, 2) provides an interpretation of the results and comments, and 3) recommends idea for increasing the ability of engineering and engineering technology graduates to be good life-long learners.

## Introduction

In his 1991 President’s Message, then Society of Manufacturing Engineering (SME) President, James F. Barcus Jr. commissioned a special committee for Life-long Learning and Career Development. About the work of this committee, he said, “the committee believes life-long learning is emerging as the most important competitive consideration.” He went on to say “. . . the need for work-life quality that ensures maximum productivity takes on new meaning—and so does learning. In fact, learning how to learn may become our #1 priority.”[1]

Numerous questions have, and are being asked regarding life-long learning including what makes a good learner and what helps a person develop the capability to learn for their entire life. With rigorous disciplines like engineering and engineering technology how does one keep up and stay excited to learn new things? Do the things we do in engineering education, or in education in general, encourage development of this critical attribute?

In order to better understand how well we were addressing life-long learning in the Department of Manufacturing Engineering and Engineering Technology at BYU, alumni and their supervisors were surveyed regarding characteristics of life long learning. Though general in it’s description of characteristics and attributes, this survey gave a perspective from industry of what is important regarding life-long learning and a glimpse of how well we are doing in developing these characteristics.

## The Survey

Selecting ten factors that have an effect on life long learning, surveys were sent to almost 2000 alumni of the Department of Engineering and Engineering Technology. These alumni represent students from four 4 year accredited programs. A discontinued Design Engineering Technology (DET) program, an Electronics Engineering Technology (EET) Program, a Manufacturing Engineering Technology (MET) Program and a six year old Manufacturing Engineering (MFE) program. Along with some demographic information about major and year graduated, the main questions were: (the response option is shown in parentheses after each question)

- 1) Did your general education classes at BYU help you become a good life-long learner? [Y or N with room for comment]
- 2) What class or subjects did you take at BYU that best promoted the skills or knowledge for life long learning? [comment space]
- 3) How would you rate the factors in Table 1 in terms of their importance in being a good life long learner? [1=not important, 2=somewhat important, 3=important, 4=very important, 5=critical]
- 4) Are there any factors you consider to be critical that are not listed here? Please list them. [comment space]
- 5) Rate how well your BYU General Education experience accomplished the things listed in Table 1. [1=poor, 2=fair, 3=good, 4=very good, 5=exceptional]
- 6) Rate how well your BYU major education experience accomplished the things listed in Table 1. [1=poor, 2=fair, 3=good, 4=very good, 5=exceptional]
- 7) How important do you believe the following factors are to your company in terms of your value to them and your future with them? [1=not important, 2=somewhat important, 3=important, 4=very important, 5=critical]

Table 1

Life-Long Learning Characteristics
Post BS Degree
Professional Organization
Desire to Learn New Things
Good Thinking Skills
Technical Experience
Intelligence
Adaptability to Change
Ability to Work With People
Religious Faith and Values
Technical Competence

Two hundred and sixty-one responses were received from alumni with a nearly equal amount from all majors as well as a nearly equal representation of more mature and younger alumni. The histogram in Figure one shows the responses broken down in years from graduation.

Adjusting for estimated database accuracy (returned surveys due to no address, etc.) the overall response rate was about 15%.

The results were analyzed from a variety of perspectives to try to determine if years in industry, major, MS vs. BS degree, etc. resulted in any significant differences in the rankings. It is interesting to note that regardless of the demographic factor used the results were very nearly the same regarding the characteristics and their importance.

Time sensitive views were also taken to see how years from graduation affected the rating of the characteristics. Again, except for some relatively small difference, some of which are noted later in the paper, the results of these views yielded nearly the same results. Evidently, graduates learn very quickly what is important in life and what is not.

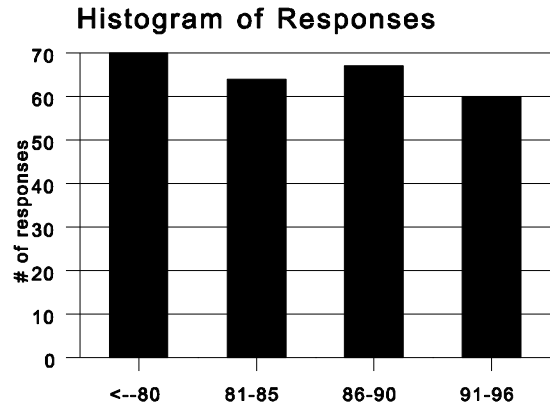


Figure 1 - Year Graduated

## Results

The survey was designed to rate the importance, in the view of the alumni, and in a separate mailing their supervisors, of the life long learning characteristics to them personally and to their companies. Additionally, the effect of the curriculum of the major and general education on the characteristics was surveyed.

In response to question 1 regarding general education, 79% answered that general education classes did help them become better life-long learners. Sixteen percent said the GE classes were of no help and 5% gave no response to this question. Most comments were as would be expected, that is that GE helped “round them out”, and opened their eyes to others interesting subjects of the world, i.e.: history, art, music, etc. About half included comments overall supportive of general education as a good method of promoting some of the characteristics for life long learning.

Question 2 regarding specific classes and subjects which promoted life long learning, shed light on what part of the educational experience best promoted continual learning from the view of the alumni. Thirty two percent of the responses identified a specific general education subject with English (writing), and Religion receiving the bulk of the votes. Interestingly 23% of the respondents indicated an engineering or technology class or subject as the best promoter of learning. Another interesting fact is that nearly a third of the responses identified a specific teacher by name as the factor most influencing learning and many others said that a teacher was the most significant factor but no name was given.

The effect of the teacher in learning is re-enforced by a survey a year earlier (presented at FIE 96) indicating that the most important factor promoting learning is a caring, thoughtful (meaning one who promotes *deep* thinking), enthusiastic, professor. [2]

After the first two questions, a list of characteristics (see table 1) was presented asking for a rating based on importance personally and to the company. Question 3, the personal response to the rating of these characteristics (shaded bars in figure 2 and 3), is probably the most important as life long learning is a personal issue regardless of where one works or

what they do. Question 7, rating the value of the characteristics to the organization where they work is next most important (shaded bars in Figures 4 & 5). Questions 5 and 6 identify how well the major and general education met the expectations of the individual and the needs of the organization.

had a tighter grouping of high scores.

Each chart in Figures 2-6 has a dark bar and a light bar. These show the responses of one question compared to another. For example, in Figure 2, the results (mean and std. dev.) of the responses to question 3, how important are the factors from a

**Personal (shaded) compared to GE**

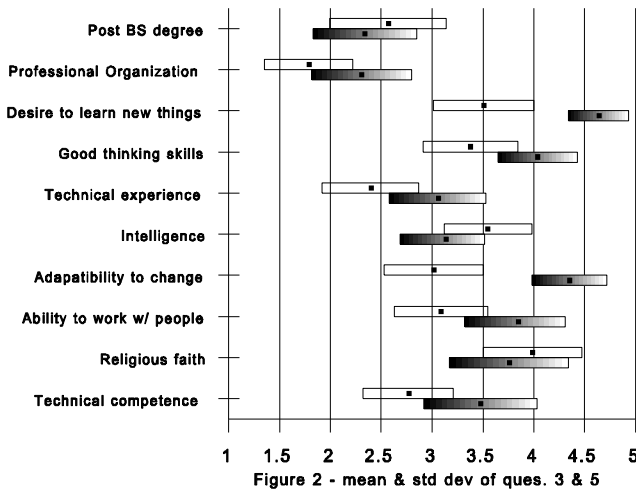


Figure 2 - mean & std dev of ques. 3 & 5

**Company (shaded) compared to GE**

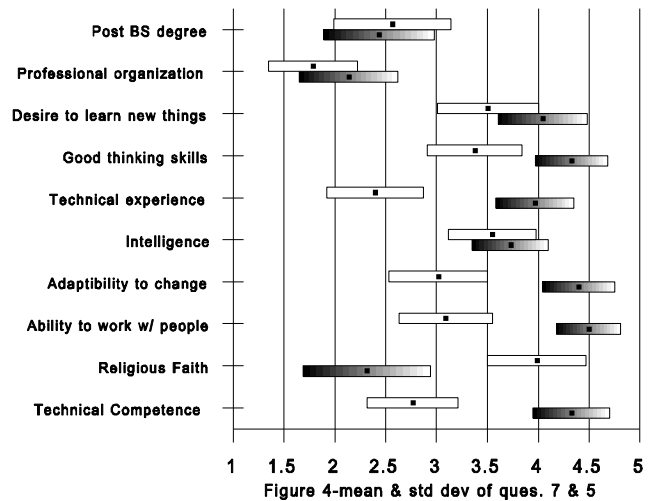


Figure 4-mean & std dev of ques. 7 & 5

**Personal (shaded) compared to major**

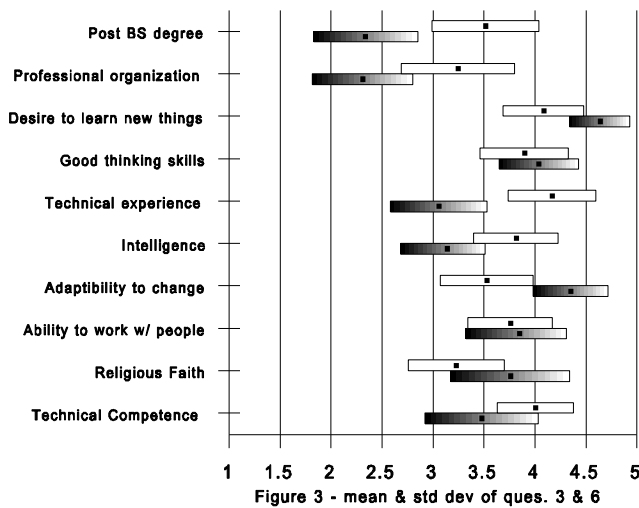


Figure 3 - mean & std dev of ques. 3 & 6

**Company (shaded) compared to major**

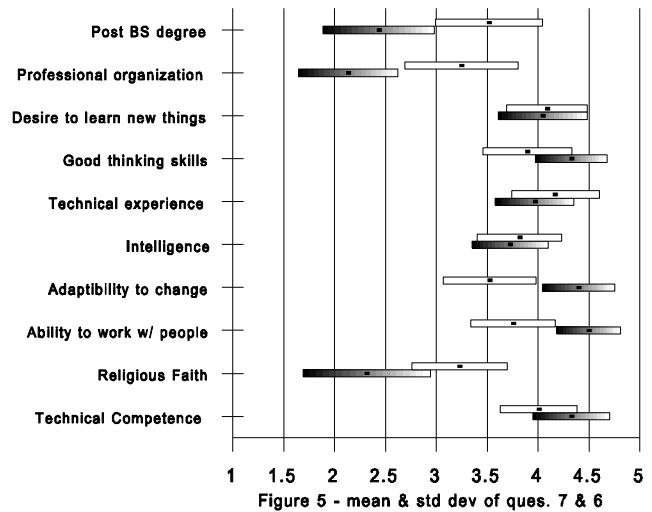


Figure 5 - mean & std dev of ques. 7 & 6

### Interpretation of the Figures

The charts used to show the results of the data give the mean (a small square black dot), and the standard deviation (the length of the bar). This method was used in order to give a quick visual representation of the spread of the responses. For example, in Figure 2 the standard deviation of 'technical competence', as a characteristic is much broader than the bar representing standard deviation 'desire to learn new things'. This indicates the range of scores was much broader for technical competence, as high as 5 and low as 2, than it was for desire to learn new things which

personal standpoint, are indicated in the shaded bar, while the data from question 5, how well did GE accomplish these things, is shown in the white bar. Placing one bar above the other shows how important the characteristic is in comparison to how well GE (in this case) fulfilled the need.

As another example, 'Desire to learn new things' is rated between very important and critical as a personal characteristic and GE just above good in terms of accomplishing the need, leaving a significant gap. These gaps (clear lack of overlap) indicate areas for improvement, and help to determine the effectiveness of major and GE courses in promoting the characteristics listed.

## Other Factors

Question #4 allowed the respondent to list factors not included in the survey. A variety of characteristics were given with the two most frequent being, first the characteristic of discipline/perseverance, and the other response being home and family life as the primary method of teaching the skills and attitudes of life long learning. Both are important and will be included in future surveys.

## Results From Supervisors

The same list of characteristics from the alumni survey was sent to supervisors of the alumni in a separate mailing and about 6 months later. This was done to determine the importance of the characteristics and rate how well BYU graduates fared in achieving them from a more unbiased company point of view. A better response was received, though still not excellent, with 198 responses from almost 1100 surveys sent for about 19% return.

For the most part the rating of the supervisors of the importance of the factors was very similar to the alumni themselves. There was some swapping of positions in the top five factors with 'Ability to work with people' number one at 4.55 and small standard deviation, followed by 'Good thinking skills', then 'Technical competence', and 'Adaptability to change' and 'Desire to learn new things' 4<sup>th</sup> and 5<sup>th</sup> at 4.29 and 4.28 averages. The comparison of the supervisor ratings with the proficiency of the employee are shown in figure 6.

The only item rated high by the alumni that was not rated as high by their supervisors was 'Religious faith and values' with the alumni rating it very important and the supervisors at just under important. This was expected as the alumni, of course, are from a religious institution. An interesting point, however, was that numerous supervisors rated it low and commented that faith and values in general are important but, at least for them, not of a specific sect. It was clear in reviewing the survey that the

question was poorly worded as some supervisors took "faith and values" as meaning the dogma and doctrine of The Church of Jesus Christ of Latter-Day Saints, that sponsors BYU, which was not intended.

The only other relatively significant difference was in 'Technical Competence'. Rated 3.5 by the alumni, it scored at 4.38 by their supervisors. One explanation for this difference is that most other characteristics, except 'Adaptability to change' and 'Desire to learn new things', also scored approximately .5 points less by the alumni than by the supervisors. Also the supervisors rated the alumni very good in having technical competence. Additionally the alumni did rate technical competence higher in terms of the importance to the company than they saw it themselves. Comments on the question to the effect that the biggest problems are dealing with people not technical issues may, to some degree, explain this difference in rating.

BYU alumni fared about the same in the eyes of their supervisors as in their own evaluation. The most significant differences were the supervisors felt the alumni were better in 'Desire to learn new things' than the alumni had rated themselves or their education, and the gap in 'Ability to work with people' was greater than indicated by the alumni. There was also a moderate gap in 'Adaptability to change'.

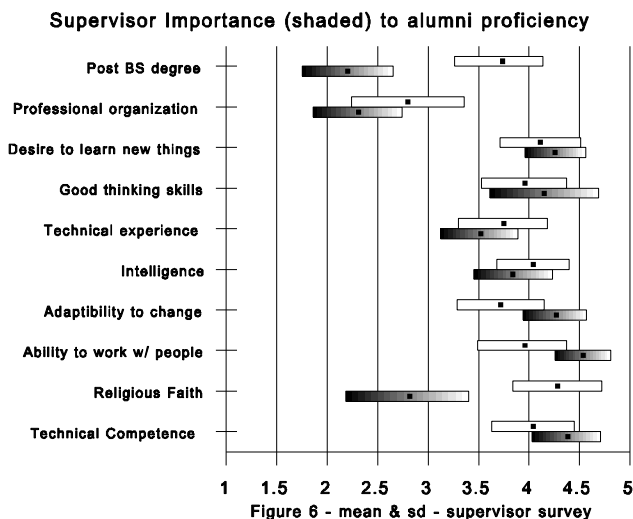
## Discussion of Results

Of the six most important (ave. score of 3.5 or above) characteristics from a personal point of view, all but two are satisfied (they have near equal means) by major or general education as shown in Figures 2 and 3. 'Adaptability to change' was not met by either major or GE, and in 'desire to learn new things' the major was fair (moderate difference in means) in terms of accomplishing this characteristic. Both of these are seen to be very important to the company as well. Of the characteristics perceived to be important to the company, 'ability to work with people' was seen as very important and only achieved marginally by the major. 'Adaptability to change', again, was seen as very important yet not met by either major or GE.

As shown in Figure 2 only two factors fell below the 'important' range, that of professional organizations and post-BS degree. An interesting unexpected point was found when analyzing responses from those who had a MS degree. The rating for post-BS degree jumps by .6 but the average still falls just below important at 2.91.

Professional organizations never received above 2.31, that being from the most recent graduates. Supervisors rated it no higher. The longer the time in industry the lower the rating for professional organizations tended to be but still close to the 'somewhat important' range. This is an interesting point for further study by professional organizations many who intend continual learning to be a benefit of a member's participation.

All characteristics except 'post-BS degree' and



'professional organizations', were considered to be at least 'important' to personal ability to be a good life long learner. 'Intelligence' (considered by many to be something one is born with), and 'technical experience' are 'important' and the remainder of the characteristics rated 'very important'.

## Conclusion

The most significant characteristics that need improvement are those with which traditional engineering education seems to struggle the most. The 'desire to learn new things', 'adaptability to change' and 'ability to work with people' are areas for significant payback in terms of meeting needs of students to become better learners. These will be better accomplished by paying more attention to *how* something is taught than to increasing the content of what is taught. In other words, more is not necessarily better, but better is better. We sometimes get so caught up in being "rigorous" that we tend to make students ill of the material. Rigor itself is often mis-defined not as thinking and learning but as stressing.

'Adaptability to change' is very important and not being achieved well both from the point of view of alumni and their supervisors. Some improvement can be gained by offering open-ended cases and questions allowing students the chance to address problems and challenges for which no answer is known. This will give them more experience and confidence in learning to learn and in the problem solving process.

'Ability to work with people' needs improvement also but is accomplished fairly well by the major according to the alumni but needs more work according to their supervisors. A time sensitive view of the data shows this has been accomplished better in recent years. More classes with team projects and instruction have evidently had a positive impact on this characteristic.

Two other areas important to both individuals and companies and needing some work is 'good thinking skills' and 'desire to learn new things.' This can be accomplished in part by broader and multi-disciplinary instruction and problem sets and in changing our paradigm about rote thinking as learning versus deep thinking. Frank Splitt of Northern Telecom stated, "engineering graduates haven't been trained to develop solutions involving multiple disciplines. . . . School should be a time for learning how to learn, how to be evergreen. We need to develop people who know how to think, how to perceive implications, how to develop relationships and connections, how to reason." [3]

Grading, particularly forced curve distribution and complicated formulas for spreading grades have a negative impact on learning. They do not promote deep thinking nor instill a desire to learn new things both critical to becoming good life long learners. This was evident in some comments made on these surveys but is re-enforced in the learning survey mentioned earlier and presented in FIE 96.

The characteristics that will promote good life long learning and which every professor can improve and use are:

- Development of good thought processes
- Desire to learn (this can be stimulated)
- Belief in ones ability
- Integrity, particularly honesty with oneself.
- Desire and ability to work with others.
- Life long learning as an attitude as we as a process.

Quoting Frank Splitt again he concludes his remarks in ASEE stating, "This does not necessarily mean more courses, but rather *new thinking* on how we teach the courses we already have. Look at it this way: Let's have our future engineers tell the time when asked, not tell how a watch is built." (Italics added.) [4]

The root and essence of life long learning is simply learning. Real and deep learning. An unmeasurable but clear expression of the responses from both the alumni and supervisor was the attitude and perspective illustrated in the style and flavor of their comments. Some were optimistic and instructive, others wooden and flat. It appears good learners seek not just for rigor but for relevance, not just for information but for wisdom, and beyond just making a living they seek to make a life. That is the essence of the "new thinking" that is required. That is relevance and wisdom in live, not just rigor and information for a living. The attitude of the student and the methods of the teacher must, therefore, not only focus on the development of the mind, i.e.: grade and graduation, but also on the growth of the heart and the soul.

## References

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