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Comparing the Scientistic* Attitude of University Freshman and Senior-year Students as an Evaluative Measure of Curricular Effectiveness

Mansoor A. Hameedy, Ph.D.
Assistant Professor, Al-Zahrā University
mhameedy@alzahra.ac.ir

Abstract

Evaluation is an inseparable part of any program, especially that of a university teaching. That's because universities are the very bastion of science and scientific culture, and evaluation and improvement are among the very values of which this culture is consisted. Hence, in a country like Iran it can be expected from the university curricula to help with the development of scientistic attitude in students in order to uphold the scientific values. Assessing the scientistic attitude of the newly admitted students and comparing it with that of the senior year students could reveal the value of the university curriculum. 236 first-year and fourth-year students from four colleges of economics, engineering, physical education, and the arts were randomly selected and, in 16 sessions, their scientistic attitudes assessed, utilizing the "bood" instrument that measures cognitive, affective, and behavioral aspects of the attitude. The findings, however, in supporting the research hypothesis, did not show a significant difference between the two groups attitude scores. Nevertheless, some colleges were significantly different than the others, which means they don't stress on the scientific values equally. Review of the curricula and the evaluation of methods and instruments in university teaching could lead to improvement in scientistic attitude.

Keywords: Assessment; Evaluation; Scientistic Attitude; University Teaching;

* Yes, it is not scientific! It is scientistic, meaning that which is associated with a scientist.

INTRODUCTION

Higher education in Iran, pursuing a multitude of goals, is not of that long of an history (Hameedy, 1999), so evaluation of higher education has even a much shorter history since evaluation research has not been embraced in general (Mahjoor, 1997; Baazargaan, 1998). Perhaps this is due to the fact that research (scientific) culture has not been strengthened in Iranian universities yet (Nafeesee, 1996; Mansooree, 1995), and as a result the very notion of university is taken differently there within. Although the concept of university is taken by some (Brew, 2001) to mean a place for systematic explorations aimed at creation and control of uncertainty, it does not seem to be considered so in Iran as its primary goal has been to train employees for the bureaucratic apparatus of the government (Nafeesee, 1996). Barnett (1997) while reminding that what we do not know about the universe is much more than the things we do, considers the university as responsible for facing the universe and lessening the unknowns about it. However, *daaneshgaah,* the Farsi word for university (which means the place of knowledge/knowing), as a place wherein "the knowledgeable" (teacher) and "the knowledge seekers" (students) teach/learn the human knowledge, can not be alien to research (the way of increasing human knowledge), since studying and researching are the two sides of the same coin, i.e. inseparable and very similar (Hameedy, 2001). Studying (learning) and researching are both planned, systematic activities aimed at creating new knowledge, even though the knowledge created by researching is new for every one and that created by studying is perhaps only new to the individual learner. As such, one can consider learning how to research as the fundamental goal in university curricula, since chief among the knowledge that a "knowledge seeker" must seek and learn is the knowledge of how to seek or construct knowledge. As *Brew* (2001) points out, it is assumed that whoever who is at a university knows what research is! However, it is not sufficient to simply know what research is. What is also necessary, in addition to knowing the why and how of research, is valuing research and being interested in it and more important of all, using it and becoming skillful in it. Hence, the main objective of the university education can be the development of such knowledge, devotion, and skills (expertise), which is tantamount to the development of scientistic attitude, in those called "knowledge seekers".

If the development of scientistic attitude is the main purpose of the university education, then there must be a common and consistent understanding of this basic concept among the educational experts and practitioners in order to make the achievement of the said objective conceivable. What is meant by attitude, according to *Weiten* (2000), is the set of all learned cognitive, affective, and behavioral responses of a person to things, people, and events. Obviously such responses can be positive and pleasant, neutral, or negative and unpleasant. Furthermore, what is meant by the scientistic attitude is the attitude similar to that maintained by a scientist toward the universe. The cognitions, affections, values, and skills that a scientist holds determine his/her habituated responses to the universe and especially to the very activity of science. The attitude of a scientist toward science can be considered as an example of positive and pleasant attitudes, as one without such an

attitude would not be a scientist. A scientist knows, for example, that objectivity and accuracy are among the basic characteristics of science and scientists, and hence, along this awareness, not only holds objectivity and accuracy dear, but upholds them in his/her actions as well. One of the areas in which one's scientistic attitude manifests itself is one's language. Using, for example, the word "latitude" where what is needed is the word "attitude" would be a gross indicator of the absence of objectivity and accuracy, and hence indicative of the absence of scientistic attitude. Among Iranian authors, there are those (e.g. Kaardaan, 1997; Shokoohee, 1997, and Ghaasemee Pooyaa, 1997) who use other words in lieu of "attitude" albeit none as far away in meaning as "latitude"!

Using words like "insight", "world perspective", or "point of view" instead of "attitude" overlooks the unidimensionality of these concepts or the multidimensionality of "attitude". *Shokoohee* (1997) considers "scientific insight" as just "another type of knowledge" which stands counter to "intuitive insight" and "emphasizes not only on seeing, but also on looking" (p.135). *Ghaasemee Pooyaa* (1997) uses the word insight to mean, "the way that one looks at the world" or "world perspective", and considers scientific insight as "looking at the world through different types of knowledge" (p.26). What he means by "different types of knowledge" is "religious, intuitive, artistic, rational, philosophical, and scientific knowledge" (Ibid.). However, *Kaardaan* (1997) views "scientific insight" as "the psychological state and cognitive activities of those who are knowledgeable, or better said, those who are researchers" (p.15). This "psychological state", according to him, "leads to behaviors that indicate the desire to understand the truth, to advance the human knowledge, and to serve the humanity" (Ibid.). Perhaps what is meant by "the psychological state" are the cognitive and affective dimensions of a person being manifested in his/her behavior, but the truth is that the word insight does not imply such multidimensionality! May be emphasizing the cognitive dimension in "scientific insight" and overlooking the affective and behavioral dimensions stem from the belief that cognitions lie beneath all affections and actions. Even so, if one wants to be inclusive of all three dimensions, the word "attitude" is, by definition, the most expressive and inclusive. The main characteristic of any attitude is that it is learned. As such, the development of scientistic attitude can be viewed as one of the fundamental goals in higher education. *Ormrod* (2000) suggests that all curricula should include activities that help with the development of scientistic attitude. *Feuer*, *Towne*, and *Shavelson* (2002) suggest many such activities that they consider being among the hallmarks of scientific culture.

One of the indicators of the scientistic attitude/culture is program evaluation in higher education. Any person with a scientistic attitude, or any group with a scientific culture, views all phenomena systematically and seeks ways of improving the system's functions. This very tendency toward the identification of shortcomings, ways of remedying them, and attempts at improving the system leads to the rational step of evaluation being taken by any program planner, implementer, or practitioner, because without evaluation it could not be determined whether the program has had its expected value, the set goals are accomplished, or where the program, in comparison to another program, stands. *Lettwood* and *Philips* (2000)

report that evaluation in British higher education has increased due to the increased emphasis on accountability, on the one hand, and the spread of research and teacher training programs, on the other. *Rattcliff* (1998) while emphasizing that student outcome should be the very basis of any evaluation in higher education refers to the ranking of the American and Canadian colleges and universities based on such evaluations. In other words, it is rationally necessary that different universities be evaluated and ranked from the perspective of what their students have learned. That is where the political dimension of evaluation becomes evident. *Henkel* (1998) reminds us that in the light of the changes in philosophical foundations of science, the very concept of evaluation has also changed to include not only process instead of product orientation, but has also revealed the political nature of evaluation. Even though *Pratt* (1997) equates being process oriented in evaluation with ignoring the product, suggests that the evaluation of higher education should focus on planning, implementing, and outcome phases. Needless to say that these phases constitute the very process of education and the evaluation of any one phase, without the others cannot lead to genuine improvement.

Educational programs in Iran are not evaluated in a way that they should have been evaluated. That is perhaps because those who are involved in education, to quote *Baazargaan* (1998), "resist evaluation for a variety of reasons" (p. 131). While the political nature of evaluation could have some thing to do with this resistance, it can also be indicative of a weak scientistic attitude in these decision makers. There are other sets of evidence in this arena (e.g. Shokoohee, 1997; Hameedy, 1999; Meerlohee, 2001). Obviously planners and implementers deprived of a scientistic attitude, would not and could not include its development in their programs, and as a result, their audience (students) would be deprived of the opportunities to develop such an attitude. *Shokoohee* (1997) has observed the weak scientistic attitude among "the planners and the implementers", but does not find it limited to the national level, as it is evident at the teachers and students levels as well. *Meerlohee* (2001) considers the relatively low level of competency among the Iranian university graduates as the result of the university curricula not paying adequate attention to research (science) and research training, and reiterates that the Iranian educational programs are neither problem oriented nor process oriented and as a result do not lead to scientistic attitude. Although alongside the above-mentioned observations, *Hameedy* (1999) has also found the content of the curricula in teacher training programs lacking in adequate research training, or *Lahsaa'eezaadeh* (1999) has documented the incongruencies in university curricula in this regard, most evidence indicating the shortcomings of the university curricula are anecdotal or not sufficiently scientific. This is further evidence of the need for systematic evaluations on the one hand, and of the spread of weak scientistic attitude among those involved with education, on the other. *Ghahremaanee* (1999), who has purportedly addressed "the internal efficiency of Iranian universities", while ignoring the qualities of the programs and those who go through them, has turned to calculating a multitude of "rates" (e.g. non-starters, dropouts, repeaters, kick outs, etc.), and then calls it program evaluation! Reporting the extent to which students unsuccessfully leave the universities is hardly the evaluation ('assessment") of the universities "internal

efficiency", as the use of the word "price" instead of "extent" can not be indicative of a strong scientistic attitude.

Volkmann and *Eichinger* (1999) refer to scientistic attitude as "scientific literacy" which includes habits like thinking and reasoning that can be learned by students if the curriculum aims at them. *Glynn* and *Muth* (1994) also consider having a curriculum that emphasizes on reading and writing as the basic step toward students acquisition of scientific literacy. *Feuer*, Towne, and *Shavelson* (2002) who regard scientistic attitude at the communal level and call it scientific culture, point out that its development is comprised of creation of habits like multidimensional, objective, and accurate observation, systematic, creative, and free thinking, unbiased, constructive, and compassionate criticism, and strong commitment to evidence. Among the agents that bring about such habits or attitude, *Papanastazio* (2002) refers to the curriculum and the act of teaching, wherein if not enough attention is paid to the development of scientistic attitude unpleasant and negative consequences, including a drop in achievement, would follow. *Simpson* and *Oliver* (1990) in a longitudinal study concluded that students' attitude toward science across grades six through ten deceases in parallel with their academic achievement. *Keeves* (1992) has also documented the decrease in positive attitude toward science through the high school years, preparing the grounds for a decrease in achievement. *Francis* and *Grear* (1999) discovered the same trend among the Irish students with boys being superior to girls. *Booh* and *Toh* (1992) report on the senior year college students' ability to reason scientifically. Most students in the study engaged in perceptual reasoning rather than scientific reasoning, as they avoided using scientific concepts in their arguments. In other words, four years of university education did not prepare the students to reason scientifically. However, *Wilson* (in Papanastazio, 2002) reports that academic success brings about positive attitude toward education and science. Such findings, despite some shortcomings, demonstrate the connection between students' attitudes and university education, and hence justify the assessment of one as a way of evaluating the other.

Perhaps the fundamental shortcoming in the above-mentioned studies, as well as the other works like *Tocci* and *Engelhard* (1991), *Leder* (1990), and *Fenena* (1980), is in their theoretical framework. Theories on attitude development and change are based on the assumption that the cognitive dimension (beliefs) is the base upon which the affective and behavioral dimensions are built and any changes in emotional reactions requires a change in beliefs and cognitions (Shrigley, 1990). However, most of the reviewed studies have reduced attitude down to its affective dimension. For example, *Papanastazio* (2002) considers attitude as one's affective tendency to react to things, people, places, events, or ideas; a reaction that can be either positive or negative expressed in statements like "I like science." "I find science pleasant." or "science is boring." are taken to be signs of positive and negative attitude toward science. On the other hand, some of the reviewed studies have focused on the cognitive-behavioral dimensions of attitude (e.g. Volkmann and Eichinger, 1999; Boo and Toh, 1998) at the expense of the affective dimension. Nevertheless, the present research considers all three dimensions together since the development of positive attitude toward science is considered valuable (Freedman, 1997; Colette and Chiappetta, 1998) and overlooking any one of the three dimensions is not

justifiable, especially since attempts at the identification of new ways for improving students' attitude toward science (Papanastazio, 2002) require a well rounded and clear understanding of the basic concept of attitude.

Having a three dimensional perspective on attitude, the present study could not only reveal any possible changes in scientistic attitude across four years of university education, but could also document any variability among the three dimensions which would lead to information on the consistency/inconsistency of emphasis on these dimensions within the university curricula. It would be rational to expect that the university experience over a period of 3-4 years lead to improvement in all three dimensions of students' scientistic attitude. In other words, the rational expectation should be that the scientistic attitude of senior year students would be more positive than that of the first year students; nevertheless, within each group the extent of awareness, attachment, and application, in regard to science, should be the same. However, based on the literature review and the identified shortcomings, the research hypothesis is that the attitude of the university students toward science remains the same over the four years of college, and if it does change, the change is differentiated across the three dimensions of their attitude.

METHODS

THE DATA COLLECTION DESIGN in this research consisted of sixteen groups of students who were tested once. The assessment took place in sixteen class sessions. In each class, the professor was contacted in advance and following the explanation of the goals of the project his or her cooperation was sought. With the professor being present in the classroom, the research assistants gave the students the necessary information about the project and the way to complete the questionnaire. Special emphasis was put on the unanimity of the participants. The time taken by different groups of students to answer the questions varied from 15-20 minutes as the purpose was for every student to have enough time to read and respond to the questions. The participants were requested to return the questionnaire as soon as they were sure that all its questions were answered. No consultations were allowed among the respondents during the data collection session.

THE PARTICIPANTS were 322 students at an Iranian institute for higher education. The institute, though unique in some respects, was deemed similar to other universities as the curricula in all Iranian universities are identical and the methods used there within are pretty much the same. Hence, the selected university is assumed to be representative enough of all Iranian universities, although because of its uniqueness, the argument could be made that as a special case in and of itself, the situation there within merits the undertaking of the study. Nevertheless, the participants were selected from among all freshman and senior year students at four of the eight colleges within the university. These colleges were randomly selected: Arts, Engineering, Economics, and Sport Sciences. Within each college two major areas of specialty were again randomly chosen. Then from among all courses offered to the freshman and senior year students in these major areas a course/hour was selected. All in all, the participants were all students attending the chosen

courses/hours, totaling 322 students. Among these were students who were neither freshman nor senior as defined in this study. To be considered a freshman the student must have completed fewer than 20 credit hours, while the seniority required the completion of at least 100 semester hours. There were 236 students meeting this criterion (136 freshmen and 100 seniors). The distribution across colleges and years was as follows:

Table 1. The number of participants across years and colleges

College / Year	Arts	Economics	Engineering	Sport Sciences
Freshman	32	54	29	11
Senior	26	36	20	18

THE INSTRUMENT used in this research was an attitude scale specially constructed to measure scientistic attitude (or attitude toward science) of the respondents. Since scientistic attitude was defined to be the learned cognitive, affective, and behavioral predispositions toward science, similar to those of a "scientist", to construct the instrument, initially a number of indicators in each of the three dimensions were identified and then short, declarative statements were constructed each including one of the identified indicators. From among all such statements written, the most outstanding ones were chosen and each given a three-point scale of true, perhaps, and false. The finished measure (*bood*) included 100 statements (44 cognitive, 24 affective, and 32 behavioral statements). The cognitive statements were written based on the scientific principles and facts demonstrating historical, philosophical, methodological, and linguistic features of the scientific endeavor. The affective and behavioral statements were written based on the cognitive ones especially those having a clear affective and behavioral manifestation. The selection and arrangement of the statements in *bood* were all done randomly in order to prevent from creating a mind set for the respondent. As such, the measure was ready to be tested and its validity and reliability assessed.

To determine the validity and reliability of the measure, initially a psychologist, based on the given definition of the main construct, i.e. attitude, examined its face and content validities and made suggestions that once implemented rendered it adequately valid. Then the measure with the help of two groups of students was experimentally scrutinized in order to make its statements further clear and explicit, and its reliability known. The students initial feedback lead to improvements in some of the statements, and the scores obtained from the graduate group were significantly higher than those the undergraduate group got. The test – retest procedure on the graduate group yielded a high correlation (0.86) between the two sets of scores. To score the responses, the three choices accompanying each statement (true, perhaps, and false) were given the numerical values of 2, 1, or 0 respectively. As such, if all the responses of a given individual were indicative of he/she having a scientistic attitude, that individual's score would be 200, and if all his/her responses were indicative of the absence of such attitude, the score would be zero. Accordingly, the score of more than 100 would mean that the individual is leaning toward having a scientistic attitude where as a score less

than that middle point would be indicative of the individual being far away from having a scientistic attitude. Therefore the collected data were assumed to be interval data in order to pave the way for the use of the selected method of data analysis.

THE DATA ANALYSIS METHOD was a within - subject mixed ANOVA, since there were two groups across four colleges each being repeatedly measured on the three dimensions of the main construct. Using this method of analysis not only made it possible to describe the two groups of participants in terms of their scientistic attitude across their fields of study, but also to infer any differences between and among them in this area.

RESULTS

The analysis of the collected data gives a clear picture of the participants in terms of their number of credit hours completed, grade point average, and average scores in each of the three dimensions of the main construct (i.e. attitude). As the tables and graphs below show, the two groups show a general and slight decline in their GPA's across the years. Obviously the numbers of credit hours completed in this period show the expected increase, however the students in Sport Sciences seem to have accumulated more credit hours than the other groups.

Table 2. The participants' mean GPA's across years and colleges

College / Year	Arts	Economics	Engineering	Sport Sciences
Freshman	18.16	18.11	18.5	16.75
Senior	17.30	16.22	15.00	16.70

Table 3. The participants' mean number of completed hours

College / Year	Arts	Economics	Engineering	Sport Sciences
Freshman	16.12	17.20	17.89	18.81
Senior	116.63	115.65	113.73	120.23

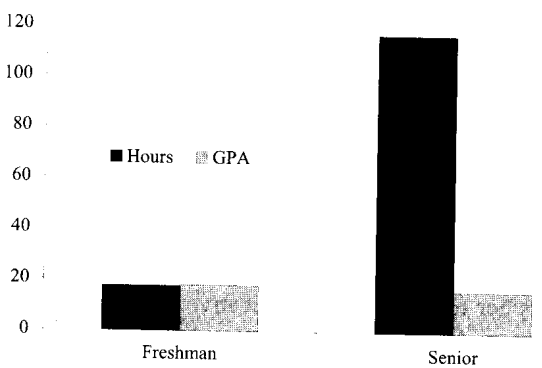

Figure 1. GPA and Number of hours across years

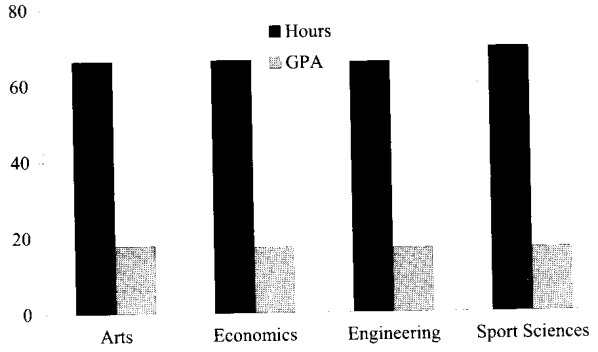

Figure 2. GPA and Number of hours across colleges

As for the attitude scores, the two groups showed slightly different means across the four colleges, with the engineering students having the highest scores among the first year students and the Sports students coming on the top among the fourth year students. The lowest scores among both the freshmen and seniors were those of the students of Economics (see table and figures below).

Table 4. The mean (above) and standard deviation (below) of attitude scores for each group

College / Year	Arts	Economics	Engineering	Sport Sciences
Freshman	131.03 19.66	129.42 14.35	137.69 14.34	132.00 17.89
Senior	133.96 14.30	127.30 15.90	130.45 15.78	134.16 18.63

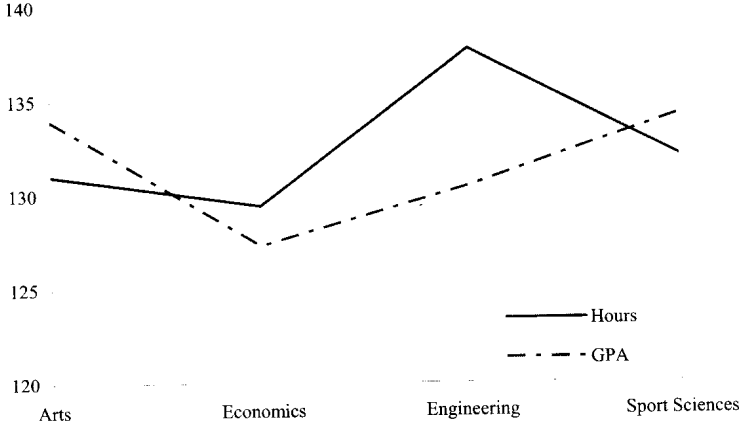

Figure 3. The change in attitude across the years in each college

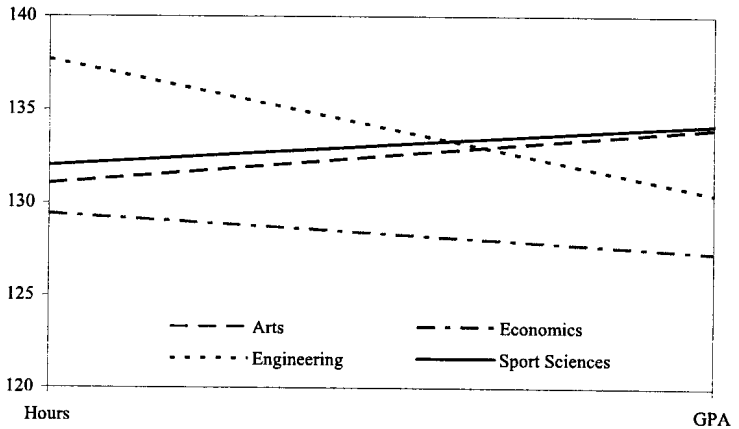

Figure 4. The change in attitude across colleges in each year

As **Table 4** shows, the engineering students show the least variation among themselves during the first year of college, while during the fourth year, it is the students in the Arts that have this feature. **Figure 3** shows the difference between the freshman and senior students in four colleges, with Engineering students showing a greater decline than the students in economics across the years. If we collapse the attitude scores across years and colleges, a clearer picture of how the scientistic attitude varies among different student groups emerges (see figures below).

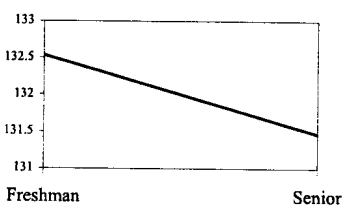

Figure 5. The overall change in attitude across the years

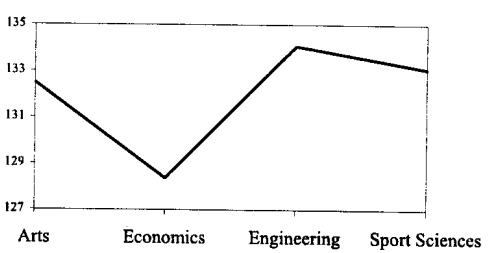

Figure 6. The overall difference in attitude across colleges

On the other hand, since the attitude scores are the sum of the scores in three attitudinal dimensions, we can get a clear picture of the difference between the three

dimensions by collapsing data across colleges and years and see that the overall scores in cognitive dimension are slightly higher than the other two (see **Figure 8**). Nevertheless, it is the affective dimension of the freshmen that stands out in the attitude data across the two years. Interestingly, this very dimension shows a noticeable reduction in the senior year (see **Figure 7**). Looking at the dimensional scores across colleges, again it is the affective dimension of the attitude of engineering students that outranks all the others, with the cognitive dimension in sports students coming next. The lowest scores in all dimensions are those of the students in Economics (see **Figure 9**).

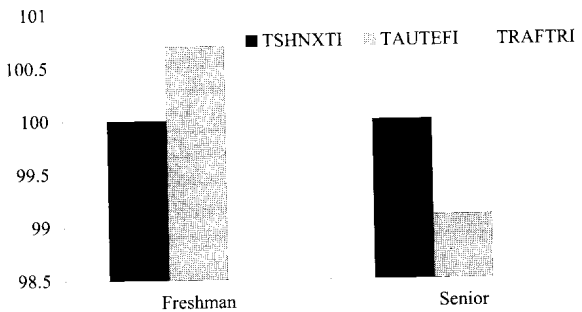

Figure 7. The difference between dimensions across years

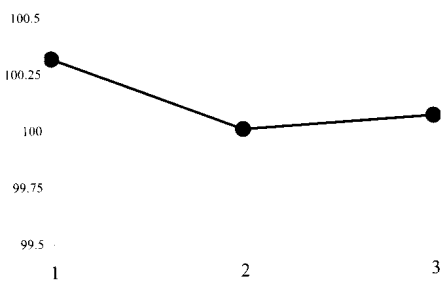

Figure 8. The difference between attitudinal dimensions

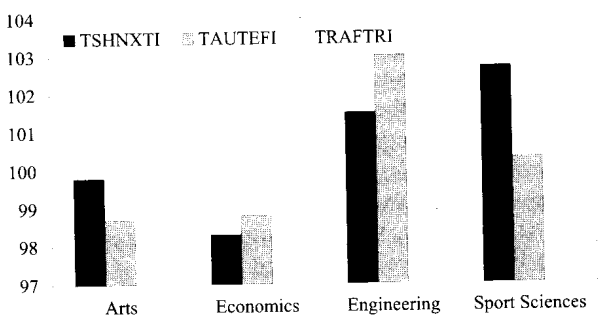

Figure 9. The difference between dimensions across colleges

Although the above tables and figures show some interesting differences between groups of students, and within the dimensions of attitude across years and colleges, further analysis revealed that only the GPA's of the students in Arts are significantly lower than those of other groups, while the number of their completed hours is significantly lower than that of the students in Sport Sciences, and the attitude scores of the Engineering students are significantly higher than those of the students in Economics ($p < 0.05$). However, to test the main research hypotheses, a 4x2x(3) ANOVA (assuming that the necessary assumptions were met) failed to reveal a significant difference between the attitude scores of freshman and senior-year students across all major fields of study.

Table 5. Between-subjects effects

Source of Variation	Variation	Degree of Freedom	Variance	F Ratio
Colleges	1130.465	3	376.822	2.103
Years	50.932	1	50.932	0.284
Interaction	639.013	3	213.004	1.189
Error	40856.211	228	179.194	

Table 6. Within-subjects effects

Source of Variation	Variation	Degree of Freedom	Variance	F Ratio
Colleges	472.287	6	78.710	1.360
Years	121.160	2	60.581	1.047
Interaction	297.121	6	49.520	0.855
Error	19030.360	456	30.303	

DISCUSSION

The main argument in this report has been that the scientistic attitude is the very part and parcel of any university education, as its development/strengthening could be considered as one of the major goals in any university setting; hence those involved in the development and implementation of university curricula need to have such an attitude in order to be able to help with its development in university students. Furthermore, it is with the development of scientistic attitude at the individual level that one can expect a scientific culture to emerge at the group level. It is within such culture that research, and in particular evaluation research, could flourish and reach its goal of improving human products such as policies, programs, etc. If in fact the goal of the university education is to further strengthen the scientistic attitude of the students, then the assessment of the students' scientistic attitude across time would be an evaluative index of the effectiveness of the university curriculum.

Considering the major goals of university education, during its rather short history in Iran (Hameedy, 1999; Nafeesee, 1996), and also the lack of popularity of evaluation research (Mahjoor, 1997; Baazargaan, 1998) in this country, it was deemed necessary to bring to light the two interrelated concepts of scientistic attitude and program evaluation by assessing the changes in students' scientistic attitude as an evaluative index of the effectiveness of Iranian university education. Such a relationship would be expected if the research role of the university were not to be

ignored (Brew, 2001; Barnet, 1997). The term attitude is taken to mean the learned cognitive, affective, and behavioral reactions of an individual to an idea or event (Weiten, 2001) and as such, the scientistic attitude is taken to be the three dimensional reactions of scientists to the universe, in general, and towards science, in particular, measurable by a set of statements in each dimension with which the respondent agrees, disagrees, or remains undecided.

Judging from the reviewed literature, it was hypothesized that the university education is not that effective in regards to the development and strengthening of scientistic attitude among students. This would imply that there would be no difference between the scientistic attitudes of first and fourth year students. The findings supported this hypothesis, as there were no differences between the 8 groups (2 years x 4 colleges) of students whose scientistic attitudes were assessed. Hence, it can be concluded that the university curriculum that they have gone through has been ineffective in this regard. The finding is compatible with that of many other studies, both domestic and international. *Francis* and *Greer* (1999), like *Keeves* (1992) and *Simpson* and *Oliver* (1990), shows a negative trend in students' attitude. It is likely that upon entering university, the Irish students, like the Iranians, would suffice to a minimal level of scientistic attitude necessary for success at their school tasks and as a result would show no observable change across four years of schooling. In other words, it is the pre-university curriculum that creates the grounds for the difficulty observed at the university level regarding scientistic attitude. However, it is not to be forgotten that all those involved in pre-university education are themselves university products, and as such the ball is back in the university's field. If the Iranian university students, like those in *Boo* and *Toh* (1998), do not use what they have learned during their university tenure, it is the university curriculum that needs to be reevaluated. The findings of other domestic research also point in this direction.

Hameedy (1996) shows that many of those involved in research apparatus of the country are not only graduates of the Iranian universities, but have passed many in-service training courses in research methods, yet have no clear understanding of what research is, leave alone using their knowledge in this area. There are studies that indicate the basic principles of science are being ignored in most of the research conducted (Hameedy, 1997a; 1999b), as there are those that show some university curricula are not inclusive of courses that could foster scientistic attitude in students, unless complemented by teachers' and students' additional efforts (Hameedy, 1999a). Furthermore, some of the people involved with the, so-called, scientific journals who are responsible for the promotion of scientific culture do not seem to be aware of science or valuing it (Hameedy, 2000) just as there are university professors who do not manifest signs of a strong scientistic attitude in their writings (Hameedy, 2001). The findings of the present research, once again, have not only shown that a problem exist, but identifies the very source of the problem. In all likelihood, it is the pre-university curriculum that does not emphasize on knowledge, attachments, and skills necessary for the development of scientistic attitude. Yet it is the university curriculum that produces planners, teachers, and administrators who determine the quality of the pre-university programs. Scientific knowledge and ways of valuing it and using it can be part of the university curriculum. In other words, although it is

difficult to identify the beginning of the problem, it is rather easy to determine where the beginning of the solution can be: University curriculum!

University curricula are in need of evaluation and improvement, and the findings of the present study not only highlight this need, but also support the findings of other scholars like *Shokoohee* (1997), *Meerlohee* (2001), and *Lahsaizadeh* (1996). *Volkmann* and *Eichinger* (1999) consider curricula as the basis for scientific habits like thinking and reasoning. *Papanastazio* (2002) believes that if the curriculum does not address the development of scientistic attitude would lead to lower achievement, and *Glynn* and *Muth* (1994) consider curriculum as the main tool for the development of scientific literacy if it emphasizes reading and writing. The Iranian curricula overlook the need for the development of the writing skills, and the students reading skills are among the lowest in the world based on the PIRLS data. Perhaps if the curriculum planners had emphasized the writing abilities, the attitude scores would not have been so low and the ineffectiveness of the curriculum so bothersome. However, curricula are not evaluated in Iran for many reasons among which one can again point out the lack of scientistic attitude, or better yet, due to the non-existence of a scientific culture as defined by *Feuer, Towne, & Shavelson* (2002). Within a scientific culture, any work, such as the present one, conducted needs to be critically evaluated.

In the present study, the selection of the respondents could cause some concern as it does not provide a representative sample of the Iranian student population and as a result findings are not generalizable. However, generalizability was not aimed at in this study; rather it was the depiction of a real situation that, for many other reasons, could be considered as representative of all Iranian universities. The generalizability of the findings to the very university, wherein the study was conducted, could be rather questionable as well, since those that were not so chosen replaced one or two randomly selected groups. However, this shortcoming was not considered to be significant enough to undermine the validity of the finding. Of course what determines generalizability, in addition to the sample being representative, is that the research situation and construct is representative too. Although the research situation did not pose any threat, the construct could do so since there is a possibility that what we called scientistic attitude is different from what the curriculum planners could have had in mind! Furthermore, some of the respondents complained about the length of the questionnaire, some thing that did not come up during the instrument trials. As a result, a revamping of the instrument should be considered prior to any replication. In addition to the replication of the present study, it is worth suggesting that, using the shortened instrument, the attitudes of the students of another university be assessed and compared with those of the students of this or another university. Prior to such undertaking, however, it is rather necessary to evaluate the university curricula in terms of their goals, methods, and instruments to see if the development of scientistic attitude is truly figured therein. Also it would be helpful to evaluate teaching methods at the university level using observation as the method of data collection. The extent of emphasis put on reading and writing skills both by the intended and the implemented curriculum, and the actual students' and teachers' competence in these areas are among other issues in need of research that would further shed light on the findings of the present study.

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