7th World Conference on Educational Sciences, (WCES-2015), 05-07 February 2015, Novotel Athens Convention Center, Athens, Greece

Factors Influencing Students' Career Chooses in Science and Technology: Implications for High School Science Curricula

Hunkar Korkmaz[a]*

[a]*Hacettepe University, Faculty of Education, Division of Curriculum & Instruction 06758 Ankara, Turkey*

Abstract

The purpose of the study was to explore / investigate the factors influencing Turkish high school students' career choices in science and technology. 1192 high school students (629 female, 558 male, 5 did not indicate their gender, age range 14-17) were administrated Career Choice Instrument (CCI) in ROSE survey together with demographic measure. Series of MANOVAs demonstrated that high school students' career choices and preferences were influenced by gender, school type, mother and father education level and family income. Univariate ANOVA on the six sub-scales of CCI revealed significant and insignificant effects of these selected factors. The results of this study were discussed the implications for high school science curricula

1. Introduction

Adolescence period has a special importance on the career development. Many research studies have been done on career aspirations of adolescents in different cultures, and some common findings are obtained about factors influencing career choices. Among the factors affecting career choices of adolescents, intrinsic factors (e.g., gender, personality factors, abilities, expectations, perceptions, and   motivational influences) and extrinsic factors (e.g., SES and cultural background, school curricula, teachers' attitudes and support for school subjects, parental attitudes and values, and societal perception towards occupations) seem to be noteworthy. Gender, one of the intrinsic factors, seems to be an important factor influencing – orientation toward science- and technology-focused careers, in favor of males (Woolnough, 1996; Boser, Palmer & Daugherty, 1998; Jones, Howe & Rua, 2000; Osborne, Simon & Collins, 2003; Lavonen, Gedrovics, Byman, Meisalo, Juuti, & Uitto, 2008). In many studies, it was found that

* Hunkar Korkmaz. Tel.: +90(312) 297 68 20 +90(312) 297 68 21.
  E-mail address: hunkarkorkmaz@gmail.com

girls do not find carrers and occupations including science and technology interesting, whereas boys were significantly more interested in such career fields.   Students' expectations and psychological satisfaction obtained from school subjects (Woolnough, 1994), school/teacher skills in teaching subjects, socioeconomic status of the family, and other family dynamics; such as parental attitudes and family support toward school subjects (OIA, 1995; Furlong & Biggert, 1999; Sjoberg, 2000; Koszalka, Grabowski & Darling, 2005; Gedrovics, Lace, & Zemesarajs, 2006) play important roles in career development. Research demonstrates that higher socioeconomic status of families has positive effect on career choices for higher prestige occupations (McWhirter, Hackett & Bandalos, 1998; Mathers & Parry, 2009). Similar to SES, career choices are also influenced significantly by parent and youth values, aspirations and plans (Otto, 2000). How is the situation in Turkey? Although there is limited research on factors influencing Turkish students' career choices, Ozdemir and Hacıfazlıoğlu (2008) found that parents and environment had a great influence on students' occupational preferences in Turkey. It was also found that students' expectations of universities varied greatly according to their social status and family income. Aycan and Fikret-Pasa (2003) indicated that career choices of Turkish university students were mostly affected by intrinsic factors (i.e., self aspirations), however, interpersonal factors (i.e., significant others' expectations) were least influential. An important yet neglected factor for career choices of Turkish students is the school type. There exist several types of high schools, each with different educational aims and specializations. High schools in Turkey in which education is for 4 years, are classified according to their academic aims as (a) Science Lycee; (b) Anatolian High School; (c) Industrial / vocational high school, (d) Commercial/vocational High school. Students, who graduate from elementary school, enter a country-wide standardized high school entrance examination (SBS as abbreviated in Turkish) and are placed in the appropriate school according to their score. Once students are placed in a particular high school, they are educated according to the unique curriculum and educational aims of that school. Thus, the school curriculum must have an important influence on students' career choices. The present study aims to illuminate the factors influencing adolescents' career choices so that vocational counseling services and curriculum developers can be improved. Following research question guided the overall study. How does high school students' career choice differ with regard to sex, school type, mother & father education level and family income?

2. Method

2.1. Participants

   This survey study aiming to portray high school students' career choices and explore the factors influencing on their choices was undertaken in the spring semester of 2008-2009 academic year in six schools in Antalya, Turkey. 1192 high school students (629 female, 558 male, 5 did not indicate their gender, age range 14-17) selected from various grades in six different high schools constituted the sample of the study. Of the participants, 228 were from science high school, 197 were from trade-oriented vocational school, 199 were from industry-oriented vocational school, 177 were from vocational schools for girls, 200 were from Anatolian high school and 191 were from general/common high school. Their father and mother education level varied. Many of the participants' mother (n=661, 55.5%) and father (n=446, 37.4%) obtained only primary education degree. Income level of the families also varied and was grouped into five levels. The monthly income of 154 families (12.9%) was 600TL and below, of 318 families (26.7%) was 601TL – 1000TL, of 281 families (23.6%) was 1001TL-1500TL, of 195 families (16.4%) was 1501TL-2000TL, and of 167 families (14%) was 2001TL and above.

2.2. Data Collection Instrument and Factor Analyse

   For data collection, Turkish version of ROSE (The Relevance of Science Education) survey developed initially by Schreiner and Sjøberg (2004) and adapted into Turkish by Korkmaz (2005) was used. In order to answer the research question, second part of ROSE which measured students' career choices and preferences was considered. A new data set merely including 26 items under the part of "*How important are the following issues for your potential future occupation or job?*" was established. Explanatory Factor Analysis (EFA) using Maximum Likelihood method was performed in order to explore the factor structures behind the selected part of ROSE with the data including 1344 cases. EFA derived 8 factors with eigenvalue grater than 1.0. Scree plot showed that six factors were in sharp descent and then started to be level off. Upon this evidence, a rotation for six factors was needed. Furthermore, initial factor analysis revealed that six of the 26 items either had low level factor loading score (lower than .30;

Anastasia, 1996) or loaded more than one factor. Before rotation, these six items (B5, B12, B14, B17, B23 and B26) were never considered and excluded for the rotated factor analysis. Thus, EFA was run again for rotation using an Oblique (direct oblimin) rotation with Kaiser Normalization. Barlett's test of sphericity produced a value of 5238.49 with a degree of freedom 190 and a significance level <.001 indicating the fitness of the factor structure to the data. The Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy was found .78 indicating the fitness of sample size for conducting factor analysis with the data. These six factors explained 38.1 % of the total variance and named based on the common characteristics of the items loaded on that factor. Name of the factors were the same as the ones declared by Schreiner and Sjøberg (2004) earlier. However, the items categorized under "Leisure Priorities" by Schreiner and Sjøberg (2004) were excluded in the study due to their low level factor loading scores. Eigenvalue of the factors were 3.81, 1.89, 1.75, 1.47, 1.16 and 1.08 respectively. Table 1 illustrates the factor structures and loadings of the remaining 20 items in Career Choice Instrument.

Table 1 Factor Structures, Factor loadings and Communalities of 20 items in Career Choice Instrument (CCI) in ROSE

	Factor					
	1	2	3	4	5	6
B10. Making, designing or inventing something	.800	-.348				
B11. Coming up with new ideas	.641				-.339	
B9. Using my talents and abilities	.545					
B8. Working artistically and creatively in art	.406					.342
B6. Building or repairing objects using my hands		-.879				
B7. Working with machines or tools		-.659				
B20. Earning lots of money			.604			
B24. Becoming 'the boss' at my job			.599			
B22. Becoming famous			.521			
B21. Controlling other people			.457			
B2. Helping other people				.677		
B4. Working in the area of environmental protection	.307			.550		
B1. Working with people rather than things				.422		
B3. Working with animals				.359		
B15. Working with something I find important and meaningful	.358				-.686	
B16. Working with something that fits my attitudes and values					-.587	
B13. Making my own decisions					-.481	
B25. Developing or improving my knowledge and abilities	.427				-.456	
B19. Working at a place where something new and exciting happens frequently						.604
B18. Working with something that involves a lot of travelling						.560

Series of reliability analyses using SPSS was run so as to calculate Cronbach's alpha (α) reliability coefficient of each factor and overall instrument with 20 items. The reliability of instrument overall was found .74. The alpha reliability coefficient of the factors ranged from .54 to .73 (see Table 2).

Table 2 Factor names, abbreviations, eigenvalues, and variances of factors

Factor Names (Abbreviation)	Items loaded	Cronbach's Alpha (α)
Factor 1. Work Creatively (CREATIVITY)	B8, B9, B10, B11	.67
Factor 2. Fix: Use hand and tools (FIX)	B6, B7	.73
Factor 3. Power and Glory (POWER)	B20, B21, B22, B24	.62
Factor 4. Care for Surrounding (CARE)	B1, B2, B3, B4	.54
Factor 5. Self-actualization (SELF-ACT)	B13, B15, B16, B25	.66
Factor 6. Dynamism and Excitement (DYNAMISM)	B19, B18	.54

2.3. Data Analysis

Data were analyzed in two steps. Preliminary analysis was firstly undertaken to examine the missing values and outliers (extreme cases) within the data set (n=1192). The pattern of the missing values was found to be random and missing values in each variable did not exceed the 10% of the given responses. Thus, replaced with mean procedure was applied (Hair, Black, Babin, Anderson & Tatham, 2006). Then, in order to assess the potential outliers, the items in the data set were standardized into z scores. Since 31 cases had z score out of the range of ±4 (Hair et al., 2006), they were treated as potential outliers and excluded from the data set. Therefore, further data analyses were performed with the data gathered from 1161 students. In the second step, five separate one way MANOVA, each of which was for different independent variables (IVs; gender, school type, father and mother education level, and income), was conducted in order to examine the main effect of each IV on six factors emerged in factor analysis. Series of two- and three-ways-MANOVAs were also conducted to determine whether the IVs had an interaction effect on the factors. Surprisingly, no significant results emerged. Thus, only main effects were reported. Before reporting the results, some adjustments were done with the alpha level. Since there was more than one dependent variable (DV), Bonferroni correction was used in order to overcome type-1 error. The alpha level of .05 was divided by six due to having six DVs. New alpha level was set as .0083. Pillai's Trace results were reported for the main effect of gender, school type and father education level since the assumption of Box's M test, which measures the equality of covariance matrixes (Tabachnick & Fidell, 2001), was violated. On the other hand, Wilk's Lambda results were reported for the main effects of mother education level and income due to satisfying the assumption of Box's M test.

3. Results

3.1. The Effect of Gender

Turkish boys' and girls' interest in science and technological careers is comparatively. The MANOVA revealed statistically significant main effect of gender on four of six sub-scales [Pillai's Trace = .195, F (6, 1151) = 46.45, p<.0083, partial η^2 = .195]. Girls placed significantly greater importance on work creatively *[F (1, 1155) = 16.17, p<.0083, partial η^2 = .014]*, care for surrounding *[(F (1, 1155) = 61.59, p<.0083, partial η^2 = .051]*, and self actualization *[F (1, 1155) = 40.89, p<.0083, partial η^2 = .034]* issues in choosing their potential future occupations whereas boys felt that fix-related issues *[F (1, 1155) = 113.41, p<.0083, partial η^2 = .089]* were more important in their career choices. Power and glory *[F (1, 1155) = .56, p>0083)]* and dynamism & excitement *[F (1, 1155) = 4.20, p> .0083)]* were not observed to be significant factors for the choice of Turkish male and female students' potential future occupation or jobs.

3.2. The effect of school type

School type was measured through a categorical variable with five levels: (1) Girls' Vocational High School, (2) Science Lycee, (3) Commerce Vocational High School, (4) Industrial Vocational High School, and (5) General High School. The MANOVA revealed statistically significant main effect of school type on five of six sub-scales [Pillai's Trace = .141, F (30, 5770) = 5.59, p<.0083, partial η^2 = .028]. Significant differences were identified via ANOVA for the all subtests. Post-hoc multiple comparison tests were then conducted using Scheffe procedure so as to examine the pair-wise differences. Working creatively *[F (5, 1161) = 4.412, p<.0083, partial η^2 = .019]* was found to be significantly more important for students in the Girls' Vocational High School *(M= 13.7*8) for their career choice than those in Science Lycee *(M=12.83)* and Anatolian High school *(M=12.82)*. Significant difference was observed among the students enrolled in different schools *[F (5, 1161) = 5.752, p<.0083, partial η^2 = .024]*. Those in the Industrial Vocational High School *(M=6.16)* considered fix, use hands and tools as more important while selecting their careers than those in the Commerce Vocational High School *(M=5.46)*, Girls' Vocational High School *(M=5.24)*, and General High School (M=5.27). However, Power and glory was not significant factor for students in all school *types [F (5, 1161) = 2.139, p> .0083)]*. Results of the multiple comparison tests indicated that the issues related to care of surrounding *[F (5, 1161) = 3.528, p<.0083, partial η^2 = .036]* was significantly more important for those in the Girls' Vocational High School *(M= 12.25)* than those in the Science Lycee *(M=11.02)*

and Industrial Vocational High School *(M=11.39)*. Care of surrounding was significantly less important for Science Lycee students *(M=11.02)* than was Commerce Vocational high school students *(M= 11.97)*. Further, care of surrounding issue was more important for General High School students *(M=12.27)* than Science Lycee students *(M=11.02)* and Industrial Vocational High School students *(M=11.39)*. Self actualization was perceived as an important factor while selecting careers for those in Science Lycee *(M=14.76)* than those in Industrial vocational high school *(M=14.11)*. Dynamism & excitement was perceived as more important factor by Anatolian High School students *(M=6.22)* than was Commerce Vocational High School students *(M=5.65)*.

3.3. The effect of mother education level

Mothers' education level was measured through a categorical variable with three levels: primary school degree, secondary school degree, and university and advanced degree. MANOVA resulted in significant main effect of mother education level on students' career choices with a Wilks' Lambda of 0.941 *[(F (12, 2282) = 5.88, p<.0083, partial η^2 = .030]*. The multivariate partial η^2 based on Wilks' Lambda was small, .030. Subsequent univariate ANOVAs indicated that there were significant group differences associated only with power and glory *[F (2, 1146) = 5.72, p<.0083, partial η^2 = .010]*, care for surrounding *[F (2, 1146) = 17.20, p<.0083, partial η^2 = .029]*, self actualization *[F (2, 1146) = 6.51, p<.0083, partial η^2 = .024]*. Results of the multiple comparison tests using Scheffe procedure indicated that power and glory *(M=11.94)* and self actualization *(M=14.77)* was significantly more important factor for those whose mother held secondary school degree than those holding primary school degree. Care of surrounding was more important factor for those whose mother obtained primary school degree *(M=11.98)* than those obtaining university degree *(M=10.81)*. Care of surrounding was significantly less important factor for students whose mother obtained university degree *(M=10.81)* than those whose mother obtained secondary school degree *(M=11.79)*.

3.4. The effect of father education level

Fathers' education level was measured through same categorical variable with mothers' educational level. MANOVA results revealed significant main effect of father education level on students' career choice [Pillai's Trace = .038, F (12, 2252) = 3.67, p < .0083, partial η^2 = .019]. Subsequent univariate ANOVAs indicated there were significant group differences associated only with care of surrounding [F (2, 1130) = 11.77, p<.0083, partial η^2 = .020]. Results of the multiple comparison tests indicated that care of surrounding was significantly more important for students whose father obtained primary school level school degree *(M=12.15)* than those whose fathers obtained university degree *(M=11.31)* and secondary school degree *(M=11.67)*.

3.5. The effect of income

Income level of the families also varied and was grouped into five levels. The monthly income of 154 families (12.9%) was 600TL and below, of 318 families (26.7%) was 601TL – 1000TL, of 281 families (23.6%) was 1001TL-1500TL, of 195 families (16.4%) was 1501TL-2000TL, and of 167 families (14%) was 2001TL and above. MANOVA resulted in significant main effect of income on students' career choices with a Wilks' Lambda = .959, F (24, 3747) = 1.897, p<.0083, partial η^2 = .010. Subsequent univariate ANOVAs indicated that significant differences existed across groups for only care of surrounding *[F (4, 1079) = 5.74, p<.0083, partial η^2 = .021]*. Multiple comparison tests indicated that care of surrounding was significantly more important for the students whose parents earned less than 600 TL *(M=11.95)* than those whose parent earned 2001TL and above *(M=11.07)*. Furthermore, care of surrounding was significantly less important for students whose parents earned 2001TL and above (M=11.07) than those whose parents earned between 601TL – 1000TL *(M=12.09)*.

4. Discussion and Conclusion

The findings of the present study illustrated that factors such as gender, school type, parental education level and income had significant main effect on adolescent career choices. The effect size of these factors varied from .010 (income) to .195 (gender).When these factors are examined in a detailed way, it can be observed that gender plays an important role in career choices of the participants in favor of females. Working creatively, environmental

sensitivity and self-actualization is observed to be important reference points for girls to decide upon a career whereas for boys, the reference point in career choice is limited to only "fixing things". This situation seems quite interesting to reveal the difference between viewpoints and priorities of the two sexes in future career perceptions, and demonstrates that girls somehow consider their future careers through a wider spectrum than boys do. The findings refer to relatively earlier maturation of girls than boys, but the educational implications of this significant finding must be considered. Boys with limited concerns in career choices point to a need for vocational counseling which is more careful for gender differences in high schools. For example, conceptual structures of both sexes about professional life could be carefully examined and additional assistance could be given to boys. The present study demonstrated that the school type had a significant effect on some dimension of career choices. Dimensions like working creatively and environmental sensitivity were found to be significantly more important for the students in the Girls' Vocational Technical High School than they were for Science Lycee or Anatolian High School, though students in those schools are the top ones with academic achievement in reference to students' academic achievement obtained from SBS (High School Entrance Exam). Similarly, fixing things had a significant importance for students in Industrial Vocational High school. What was important for those in Science Lycee, on the other hand, was only self-actualization, which can be explained by individual and/or family awareness. However, the effect of school curricula seems to be of special importance on students' career orientations.

In Turkish education system, elementary school graduates take standardized entrance tests called as SBS (Level Determination Exam) and OKS and they are placed in a high school based on their academic achievement from these exams. Test scores are ranked from top to bottom as Science Lycee, Anatolian High School, Vocational High School and General High School. Curriculum of each school type has philosophy, ideology and educational objectives of its own. For example, Science Lycee focus primarily on training future scientists through a science and math oriented curriculum, whereas industrial vocational high school focus more on training for men for the industry through a curriculum with more field practice in professional sectors. Thus, these all are evidenced that Science Lycee students have higher, long-termed and somehow harder-to-achieve goals determined long before they take the test; they pass through a competitive preparation period. Thus, those students do have significantly higher scores at self-actualization, due to the higher prestige of the school and their satisfaction of academic achievement.

Dynamism and excitement was perceived as more important by Anatolian High School students than was Commerce Vocational High School students, probably because the scope of Anatolian High School is relatively broader when compared to Science or vocational schools. Anatolian High School focuses on raising distinguished seniors of the society, including Professional in science, social science and business. Thus, students of Anatolian High School may have a preference for dynamic, interpersonal relations and excitement in their future careers, when compared to other schools which have a narrow scope. Although the present study investigated the effects of intrinsic (i.e. ability, motivation) and extrinsic (i.e. family dynamics, teacher characteristic) factors on adolescents' career choices, findings about the importance of curricula demonstrate that curriculum may be a possible factor that needs to be studied in a detailed way in future studies. School curriculum seems to exist between intrinsic and extrinsic factors as they include cognitive, affective and psychomotor objectives/attainments which are determined according to the school's basic philosophy, ideology and vision. When it's considered that high school education in Turkey lasts 4 years, it can be speculated that high schools are rather critical units to build up a particular philosophy and ideology on young generations.

The findings highlight the importance of school type on career choices, yet future research is needed to analyze the contents of the curricula of high schools with different philosophies and ideologies. Power and glory, and self actualization were significantly more important for those whose mothers held secondary school degree than that holding primary school degree. This can be explained as mothers who have a medium level of education tend to encourage their children both intrinsically and extrinsically. The interesting finding here is that care for surrounding was more important for those whose mothers obtained primary school degree than those obtaining university degrees. At the first glance, this finding seems surprising, but when examined thoroughly, it can be speculated that mothers with low education level have blue collar jobs activities which have stronger bonds with the physical and social environment; such as agriculture or house cleaning. This means that low-educated women are role models for their children to have more interactions with the surrounding. When women gain higher degrees in education, they begin to lose the interaction with the surrounding. Most high educated women have white-collar jobs work with computers in individual environments. Similar results were obtained for father education level. The higher the educational level of females, the less social or physical care for the surrounding.

The above findings were consistent with the income level of the family. Students with the lowest income level perceived care for surrounding significantly more important. This situation confirmed the speculations about the

effect of family socioeconomic level (education and income) on students' career choices. Similarly, care for surrounding was perceived significantly less important by students with the highest income level. It seems that improvement on socioeconomic status leads to a decrease in care for surrounding; or environmental sensitivity. Thus, curriculum specialists, teaching practitioners and parents need to cooperate to find out ways of increasing sensitivity on youngsters. To sum up, findings of the present study revealed that factors like gender, school curricula, and socioeconomic status (parental education and income) do have significant effects on adolescents' career choices. Although future in-depth research is necessary to further investigate and improve these factors, the findings have critical value to analyse some of the basic influences on career choices in Turkish society, and they may be utilized to create a platform to discuss and shape our educational needs in the present and future. Furthermore, analysis of the curriculum of the participating schools is strongly suggested so as to explore the possible effect of content coverage, educational philosophy and mission on students' career choices and preferences. With the present study, the effects of some of the selected background variables on students' choices were investigated. These factors explained the variances in students' career choices to some degree. However, there are some other extrinsic and intrinsic factors which were not studied in the present study. The remaining unexplained variance should be examined in the future research. For example, the correlation study can be designed to investigate the association between students' various level of interest areas and their career preferences.

Acknowledgement

References

Aycan, Z. and Fikret-Pasa, S. (2003). Career choices, job selection criteria, and leadership preferences in a transitional nation: The case of Turkey. *Journal of Career Development, 30 (2), 129*-144

Boser, R.A., Palmer, J.D. & Daugherty, M.K. (1998). Students' Attitudes toward Technology in Selected Technology Education Programs. *Journal of Technology Education, 10(1),* 4-16.

Furlong, A. & Biggert, A.(1999). Framing "Choices": A longitudinal study of occupational aspirations among 13-16 year olds. *Journal of Education and Work, 12(1*), 21-36.

Gedrovics, J., Lace, I., & Zemesarajs, R. (2006). Criteria for occupation's and future job choice among youngsters in post-socialist countries. In: Izglitibas ekolojika un profesionalas studijas. Riga, p. 43-48.

Jones, G.M., Howe, A.& Rua, J. (2000). Gender Differences in Students' Experiences Interests, and Attitudes toward Science and Scientists. *Science Education, 84 (2),* 180-192.

Jöreskog, K., & Sörbom, D. (1993a) *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Hillsdale, NJ: Lawrance Erlbaum Associates

Korkmaz, H. (2005). Can be changed students' images of science and scientists in a project learning setting? I. National New approaches in Science and Technology Education Symposium: Project Based Learning. Selcuk University & Yasemin Karakaya Education and Health Foundation, 18 November 2005, Ankara

Koszalka, T.A., Grabowski, B.L., & Darling, N. (2005).Predictive relationships between Web and Human Resource use and middle school students' interest in science careers: An exploratory analysis. *Journal of Career Development, 31(3),* 171-184.

Lavonen, J., Gedrovics, J., Byman, R., Meisalo, V. Juuti, K, & Uitto, A. (2008). Students' Motivational Orientations and Career Choice in Science and Technology: A Comparative Investigation in Finland and Latvia. *Journal of Baltıc Science Education, 7(2),* 86-102.

McWhirter, E. H., Hackett, G., & Bandalos, D.L. (1998). A causal model of educational plans and career expectations of Mexican American high school girls. *Journal of Counseling Psychology, 45(2)*, 166-181.

Office of International Affairs (OIA), (1995). Careers in Science and technology: An International Perspective. Washington D.C.: National Academy Press.

Osborne, J., Simon, S. & Collins, S. (2003).Attitudes Towards Science: A Review of the Literature and Its Implications. *International Journal of Science Education, 25(9*), 1049-1079.

Otto, L.B. (2000). Youth Perspectives on Parental Career Influence. Journal of Career Development, 27 (2), 111-118.

Özdemir, N. and Hacıfazlıoğlu, Ö. (2008). Influence of family and environment on students' occupational choices and expectations of their prospective universities. Social Behavior and Personality, 6 (4), 433-445.

Sjoberg, S. (2000). Science and Scientists: The SAS- Study. Cross cultural evidence and perspectives on pupils interests, experiences and perceptions.- Background, Development and Selected Results. Department of teacher Education and School Development, Acta Didactica 1/2000, University of Oslo. Available at: http://folk.uio.no/sveinsj/SASweb.htm

Woolnough, B.E. (1996). Changing Pupils' Attitudes to Careers in Science. *Physics Education, 31(5),* -301-308.