Research Journal of Applied Sciences 10 (8): 317-323, 2015
ISSN: 1815-932X

Contributions of Cultural Elements, Lab Learning Process, Parents and Peers' Support and Academic Motivation on the Level of Technology Skills among the High School Students in West Sumatra

Erman Har
Fakultas Keguruan dan Ilmu Pendidikan, Universitas Bung Hatta, Padang, Indonesia

Abstract: The purpose of this study is to discuss some of the findings studied about the relationships of several environmental factors on several students' science learning factors which produced certain cultural learning behaviors. This study focusses on the science students' achievement of certain level of science-based technology skills which is influenced by the science learning in the classroom, lab learning process, parents and peer support and academic motivation. In addition, further analysis was done to see if residential location might influence the level of technology skills. A survey method was employed using a questionnaire to collect the data. The 449 high school students in the West Sumatera, Indonesia was randomly selected to administer the questionnaire. Both qualitative and quantitative data analysis were used. The results showed that there is a significant difference in terms of the level of science-based technology skills of the respondents based on their residential location. Students who came from the outside of the suburb scored the highest level of science-based technology skills, followed by those who live in the city and the suburban. The independent variables such as the science learning process in the classroom contributed 27.7%, science learning process in the lab contributed 20.4%, parents and peer support contributed 5.7% and finally the academic motivation contributed 1.6% on the level of technology skills. The qualitative findings explained how and why the students who lived outside of the suburb areas acquired the science-based technology skills in the agricultural activities. The findings suggested that emphasis should be given on the importance of science learning process in the classroom and science learning process in the lab on increasing the level of science-based technology skills of the students while academic motivation and parents and peers' support should not be ignored.

Key words: Science learning process in the classroom, science learning process in the lab, technology skills, academic motivation, parents and peers' support

INTRODUCTION

Many studies have been carried out and reported about effective teaching and learning methods in science subjects. A measure of a good method is it increases the motivation of students to learn science, attract them to take own initiative to learn science, increase their involvement in science learning activities and finally improve their literacy and achievement in science (Chin and Brown, 2000; Musheno and Lawson, 1999; Gobert and Clement, 1999; Hanrahan, 1999). In research, Zurida suggested that teachers should understand the appropriate teaching and learning strategies for learning science concepts. Among the many suggested methods of teaching science is a constructivist approach that explains how students develop the meaning in the process of getting the knowledge of science. The inquiry approach also involves students actively in improving their understanding related to scientific knowledge. Con (2004) stated that science teachers need to change the traditional mode of teaching science such as just refer to curriculum for determining suitable science teaching models in order to improve student's understanding about what they need to learn. Whereas teachers can extend beyond the curriculum-based teaching method by developing the students' creativity skills and imagination which is in line with the view of the 21st century science curriculum in addition to the acquisition of general science knowledge and principles. Innovative, creativity and critical thinking should be developed or integrated in the current science curriculum effectively and efficiently (Rejskind, 2000).

Science-based technology skills: In a study conducted by Kamisah, they found that the skills based on scientific evidence tend to be the most skills acquired by students. Students will have a pool of skilled technology efficiency and tend to use technology for the benefit of themselves and society. The characteristics of

the technology-skilled students who have the knowledge and the feasibility of technology knowledge to carry out their tasks well can be developed. In a study conducted by Mohamed and Ismail (1997) found that those students' attitudes and interest in the use of microcomputers in science education is positive. Students agreed with science teachers for teaching computer skills because they can learn new skills for themselves, save time and be more to learn science because of the aid of the computers. Integration of computer technology as one of the general technology skills, can help students to develop a positive interaction during doing collaborative learning activities in the classrooms. According to Waterman, Jr.., Waterman and Collard, in most organizations today, workers need to have the endurance of labor, have high dedication and able to adapt their knowledge with the changing developments of workplace. Thus, science students need to be equipped with the technology skills to adapt to these changes.

The current practice of learning the science process skills in schools has been based on psychological theory such as from the personal constructivism and sociological perspectives. However, recently social constructivists, investigators and education experts are now trying to apply the perspective of anthropological theory. These experts are trying to look at the process of learning science skills in schools from the environmental and cultural settings (Cobern and Aikenhead, 1998).

Several studies were conducted on the influence of students' own cultural backgrounds (such as student prior belief and knowledge) in the classroom process of learning which played very important role on students' mastery of the learning materials (Aikenhead and Jegede, 1999; Baker and Taylor, 1995; Cobern, 1994; Cobern and Aikenhead, 1997; Maddock, 1983; Shumba, 1999). For example, a similar study conducted by Ogunniyi *et al.* (1995) stated that cultural background brought by teachers and students into the classroom, especially during the science learning process contributed to the contextual and meaningful atmosphere of learning and teaching. Baker and Taylor (1995) pointed out that the understanding of the influence of culture in the process of learning science in the classroom still were at its infancy. For example, the failure of certain states in the west of USA in integrating cultural elements in the national the science curriculum. Second, they pointed out that the cultural background of each student which affect the way students will master science concepts should be made aware among the teachers in school. In details, students' feelings and understanding about a society based on their cultural participation play a role in interpreting the absorption of new knowledge (science concepts).

Lab learning process: Many studies have been undertaken to determine the effectiveness of learning using laboratory activities in science education to help improve students' cognitive, affective and objective achievements (Hofstein and Mamlok-Naaman, 2007). Science laboratory is considered as one of the elements in the learning environment space besides the classroom, real life field or any room. There are two major components of the learning environment which are the physical component and psychosocial component. Both these components complement each other in creating and shaping the learning environment that affect the learning process. Since, the science learning process in schools mostly occur in the laboratory which usually have complete science based equipment, it has a good potential to engage students in authentic assessment. Through this authentic assessment, schools can figure out students' own problems to be studied, establish relevant procedures and make individual related inferences (Chiappetta *et al.*, 1998). In this environment, students can learn actively, working in small groups and continue to interact with the materials or with a model of teaching which investigates the phenomenon of current science development (Hoftein and Lunetta, 2004). Teaching and learning by using science laboratories can provide positive results in addition to improving students' attitudes and interest in science (Hoftein and Lunetta, 2004). In conclusion, in the context of education, students' and teachers' satisfaction is influenced by environmental qualities of classroom setting and in this case the science laboratories (Guolla, 1999).

Parents and peers as social learning environment: According to Vygotsky's Theory, the social environment is a good media for people to learn on how a student interacts with his or her surrounding world which could transform their minds (Schunk, 1984). The reason is, these students develop their responses and concepts related to the environment. Therefore, a school is not only a place which comprises of physical structure of the buildings alone but also a space which promotes learning and feelings in a broader sense of human environment. This sort of human environment is a set of group and personal culture which students bring to the class.

The interpersonal relationships at schools are very important for the process of learning activities to realize and provide useful experience for students. Vygotsky *et al.* (1978) in his socio-cultural theory has put forward the concept of proximal development zone which uses the term of scaffolding as a teaching strategy. Zone

of proximal development is the distance between what students can create by learning and what competences they have to assist those learning. Scaffolding-based teaching strategies can provide support and assistance for the individual's zone of proximal development to expand based on individual student's capability (Chang *et al*., 2002). When scaffolding strategy is being used, teacher provide a variety of support models to enhance student's learning. Activities provided as scaffoldings will facilitate students to perform their tasksalone in the long run (Olson and Platt, 2000). If a student can complete a given task with the help of a scaffolding, he is said to have been helped through the zone of proximal development (Bransford, 2000). Vygotsky defines scaffolding as a method which teachers use in supporting students to be able to learn continuously. Scaffolding is an important aspect of temporary scaffolds process. If students' motivation increased, Scaffolding is given teacher will be reduced, so that in the end the students can complete their tasks alone, without relying on others (Chang *et al*., 2002). By the way, one goal of educators if using Scaffolding approach is to aim to push student learn creatively and independently in teaching, it can bee seen from the ability of students in solving any problem alone. If one's knowledge increases as well as learning to be more competent, one educator will slowly reduce support that has been given. According to Vygotsky by using Scaffolding, teachers no longer need to be given because the student has formed a more sophisticated cognitive system in teaching science in the part of social support or scaffolding method in learning a new material. According to Tappan (1998), Scaffolding can provide the aim of learning obviously and reduce the error of students in understanding the concept. Scaffolding can also help students understand why they were given the task of doing something and why the tasks are more important. Students can also refer to the resources to do the job when given by educators that aims to save time, reduce errors and circumvent the disappointment.

Academic motivation: Sharifah Alwiah Alsagoff in Paizah stated that the students' interestin learning can drive their attention to a subject. Their interest acts as the foundation for them to move their own in learning science whether at schools or home. If this happens, science teachers will play a less significant role in ensuring that students will learn on their own because of their motivation to learn science and consciousness to learn science. According to Murray, motivation to learn can be divided into two types, first, external motivation and secondly internal motivation. Internal motivation is the desire that comes from within a person while the external motivation is the desire that is caused by the external environment from outside. In the context of this study such motivation can be defined as the science literacy motivation which comes from the internal desire to understand and know science. Both the internal motivation and external motivation can influence each other such as external motivation can enhance the internal motivation. On the other hand, Feldman and Kearsley talked about the theory of cognitive motivation. He said a student will be actively engaged and feel satisfied if he or she undertake his or her own study effort and feel rewarded. Midgley (1993) found that level of motivations can be caused by the different characteristics of the learning environment experienced by students. Although, it is difficult to know how exactly to motivate students, research shows that there are common dimensions that can be applied to most students such as the role of the teachers who can spark students' motivation. Another type of cognitive motivation is originated from the goal theory which focuses on the goals of students who want to achieve something (Ames, 1992; Maehr and Midgley, 1991; Midgley, 1993). Those goals can be task goals or objective goals. For example, the objective goal is a student who is trying to improve his or her own understanding of science.

Attitude towards science has a multi-dimensional nature. It is a neutral mental inventory combined with the students' experiences. She argued those multi-dimensional attitudes include: attitudes toward science teachers, anxiety toward science, the interests of science in society, concepts of science, learning fun in science and motivation in science. Educational experts argued that to inculcate scientific attitude and practice in the science classrooms, teaching methods need to give students the opportunity of creating science-based objects or projects. Attitudes towards science mean students have found a positive attitude they think that science and technology is important for them. According Kamisah, research related to the measurement of attitudes toward science should involve aspects of the deity (monotheism) in order to measure the attitude of coherent and relevant to the philosophy of integrated science education curriculum.

Bricheno (2000) stated that the scientific attitude and a positive attitude towards science is the direct result of the experience of students with science teaching and learning activities especially in activities that provide passage for the active involvement of students. He said in the organization of science teaching pedagogy,

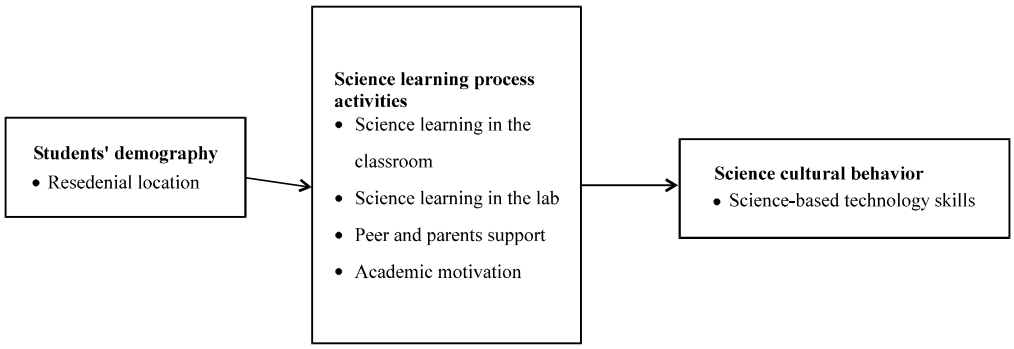

Fig. 1: Adapted from Stoner and Wankel System Management Model

the beginning level is critical and as they move to the higher levels of learning, there is a strong evidence which shows that students' attitudes are formed strongly.

In summary, these theories and methods have helped educators apply the principles of teaching and learning beyond the traditional curriculum-based teaching method which should guide the practice of teaching and learning in secondary schools in Indonesia. These new methods from the perspectives of Indonesia science teaching issues should help to increase the percentage of high school students' achievement in sciences subjects such as chemistry, physics and biology. Although, there will still some smaller groups of students who are less successful and not able to optimize their learning opportunities through these new methods of teaching science, these methods can still be useful to help the majority of them. As of today, more and more science educators had recognized the importance of considering the cultural science learning process, lab learning process and parents and peers support through scaffolding to stimulate student's motivation to learn science independently as a way to improve their educational qualities. It means that the challenge of Indonesia's educational institutions today is to learn about these new perspectives and apply appropriate methods in order to improve the science student's academic achievements.

These new perspectives of teaching methods in science are more effective because students will be more interested and inclined to learn on their own and more inclined to work in groups. When they can learn on their own and work in groups they are more willing to accept something publicly while gaining knowledge from each other. During this processes of learning, learning can occur through a variety of ways such as observations and learning processing occur differently among them. For example, some individuals can only see things concretely when other can see something in the abstract.

Conceptual framework of the study: The conceptual model for this for this study was adapted from the Stoner and Wankel System Management Model. This model looks at a school as a system which consists of several components and parts that interrelated with each other. The whole organization has to be seen as a whole not as separated components. This means that any activity in each of the components will influence any activity in other components of the organization. There are three main important components in this model which are input, process and output. In terms of input, this model refers to several environmental factors which will influence the middle component. However, in this study, the focus is on the residential location even though the original study looks at several other factors. In terms of the process, this study focus only on the science learning in the classroom, science learning in the lab, peer and parents support and lastly academic motivation. Again, the original study had looked into more than these factors. Lastly, the output component which is only discussed in this study is the science-based technology skills. All these three components are interrelated and influence each other in terms of the outcomes (Fig. 1).

Purpose: This study aims to determine the level of technology skills of high school students in West Sumatera and to what extend the science learning elements such as science learning in the classroom, lab learning process, parents and peer support and academic motivation influence their level of technology skills. Specifically the objectives of this study are:

- To determine the level of high school students' technology skills based on their residential area
- To explore qualitatively of the types of technology skills those students usually know
- To determine the level of influence of the science learning elements such as culture, lab learning process, observe the contribution the process of science learning to student's technology skills

MATERIALS AND METHODOS

This study used a survey method. A questionnaire with 5 likert scale was develop to collect the data. The sample of this study is high school students at grade II in science classes throughout selected schools in West Sumatera, Indonesia. Qualitative data was also collected to gain the understanding of certain results in the quantitative data. Thus, four selected number of teachers and students were interviewed. The number of samples were selected using proportional sampling method based on zones in the West Sumatera. A total of 449 grade II students from the sciences classes were randomly chosen. Based on the pilot study, the Cronbach alpha value of learning science elements was 0.78 and the Cronbach alpha value of technology skills was 0.84. Descriptive data analysis (meanand standard deviation) and inference analysis such as Multiple Regression test was applied.

RESULTS AND DISCUSSION

With reference to the first research objective, the level of the grade II students' technology skills based on their residential areas shows that the overall level was high (Mean = 3.98, SD = 0.39). However, the mean scores of those students who live outside of the suburb scored the highest among the three groups. For example, the students from the outside of the city scored mean 4.08 (SD = 0.44) compared to the students who live in the city with mean score of 3.96 (SD = 0.39) and students who live in the suburb with mean score of 3.93 (SD = 0.34) (Table 1 and 2).

With reference to the second research question, qualitative data analysis show that students already have some simple technology skills which was evidenced by the interview data from the four students:

Table 1: The level of high school students' technology skills based on their residential area

Location of residence	N	Mean	SD	Interpretation
City	205	3.96	0.39	High
Suburb	141	3.93	0.34	High
Outside of city	103	4.08	0.44	High
Total	449	3.98	0.39	High

Table 2: Analysis of differences in high school students' technology skills based on their location of residence

Sources	df	CD	MR	F-value	Sig. p
Inter group	2	1.386	0.693	4.498	0.012
In a group	446	68.716	0.154		
Total	448	70.102			

Significance level up to p<0.050; Guidance df = Degree of Freedom; CD = Coefficient Determinant; MR = Main of Residual

"….yes I can reproduce plants by grafting and understand the tissue culture but not yet tested, is still in the stage of understanding…"
(Student 2)
"…like my friend too, I've tried tissue culture but less successful…" (Student 3)

Additional interviews showed the same results such as the following:

"…I've been learning about making out tofu by way of deposition reaction, …given vinegar so that tofu can be deposited…" (Student 4)

The students' data were triangulated with their teachers' data such as the following:

"…This technology skills acquired by the students usually are in the field of agriculture, how to growcrops. Even though the technology skills that they know are still simple ones…" (Teacher 4)

"Technology skills in particular areas of science for high schools, ... the orientation is to continue the study up to college, however, we tried to make sure the students maintain these skills by adding the subjects of entrepreneurship, we classify it into self-development, we provide a variety of technology skills, for example in the field of chemistry, we provide post-harvest processing. If the field of IT, we provide the ability of making graphic design by using computers and in the field of agriculture, we provide their skills byteaching them how to do grafting and right cuttings of plants" (Teacher 3)

Based on the results of Table 1 and interview sessions with the selected teachers and the high school students they tend to have technology skills at a high level. However, may be due to the background of their families, they usually have the technology skills in the field of agriculture. For example, they know how to makeseedlings by cuttings and grafting, make fertilizer from the plant material, animal urine, making food with the help of yeast, using a computer and make a product from natural materials. In addition, those from the outside of the city have the highest level of technology skills compared to those who live in cities and suburbs. According to Hughes-Freeland (1998), students who live in cities and suburbs did not have the exposure of agricultural based technology skills because of the crowded housing areas they live at. In addition due to low income groups, their parents can't afford to provide them with computers and gadgets.

Table 3: Multiple regression analysis for elements of science learning that contribute to technology skills

Elements of learning science process	B	Corrected	β	t	Sig.	r	R^2	Constribution
Learning science in the laboratory	0.242	0.043	0.276	5.640	0.000	0.452[a]	0.204	20.4
Support from parents and peers	0.158	0.042	0.189	3.755	0.000	0.511[b]	0.261	5.7
Motivation	0.165	0.052	0.173	3.177	0.002	0.527[c]	0.277	1.6
Constant	1.750	0.172						

Multiple regresion = 0.527; Coefficient determinant = 0.277; Corrected = 0.052

With reference to the third research objective, the multiple regression test shows the contribution of science learning elements such as cultural elements, lab learning process, parents and peers' support and academic motivationto student's technology skills. Other four variables are not discussed in this study. Thus, Table 3 shows the decisions of Multiple Regression Analysis (Stepwise) administered to all respondents in high school in West Sumatra only for the three variables. Regression analysis in the table involving three independent variables which are learning science in the laboratory, support from parents and peers and academic motivation. All of the three variables concerned have significant effect ($p<0.050$) on the level of technology skills shown in Table 3.

With reference to Table 3, three of them contributed significantly on the students' technology skills. The highest variable contributed to the level of technology skillsis lab learning process (27.7%), followed by the parents and peer support (5.7%) and lastly the academic motivation (1.6%). The main contribution of technological skills for high school students is learning in the lab ($\beta = 0.276$, $t = 5.640$ and Sig. $p = 0.000$) which contributed as much as 20.7%. The second variable which support from parents and peers contributed 5.7% on the technology skills of the high school students ($\beta = 0.189$, $t = 3.755$ and Sig. $T = 0.000$). The third contribution of variable to the student's technological skills is academic motivation ($\beta = 0.173$, $t = 3.177$ and Sig. $p = 0.000$). This result means that if academic motivation scores increased by one unit also increase high school students' technology skills as many as 0.173 units.

Value of r = 0572 shows that the correlation between high school students technology skills variables and linear combination of three variables forecasters. The value $R^2 = 0.277$ showing the position of phase correlation and contribution or influence between the independent variables were selected on the technology skills of high school students. Generally, three independent variables that contribute significantly to the technological skills of high school students can be formed based onfollowing regression equation:

$$Y = 1.750+0.276X_1+0.189X_2+0.173X_3+0.172$$

Where:

Y = Technology skills
X_1 = Learning In the laboratory
X_2 = Support form parents and peers
X_3 = Academic motivation
Constant = 1.750
correction expert = 0.172

CONCLUSION

The results showed that the students' technological skills are at a high level in cities, suburbs and out of town. Students lived inoutside of suburbs have thehighest level technological skills versus students lived in city and suburban. This occurs because the student lived inout of town have more opportunities to perform their experiments, interviews with teachers and students also said that students have high-tech skills, although, the technology skills those are simple. Learning in the laboratory has contributed to the high-tech skills of students. When the support of parents and peers and academic motivation also contributes significantly to students' technology skills. Robiah *et al*. (2002) also said that generally parents and outside agencies to give support to students and coaches science and technology but that support is given in the form of encouragement and moral support only they are not directly involved in the learning of science and technology. Therefore, to generate and build the technology skills of students, teachers and parents need to provide opportunities and guidance for students to create experiments that can improve their technology skills.

REFERENCES

Aikenhead, G.S. and O.J. Jegede, 1999. Cross-cultural science education: A cognitive explanation of a cultural phenomenon. J. Res. Sci. Teach., 36: 269-287.

Ames, C., 1992. Classrooms: Goals, structures and student motivation. J. Res. Sci. Teach., 84: 261-287.

Baker, D. and P.C. Taylor, 1995. The effect of culture on the learning of science in non-Western countries: The results of an integrated research review. Int. J. Sci. Educ., 17: 695-704.

Bransford, J., 2000. How People Learn: Brain, Mind, Experience and School. National Academies Press, Washington, DC., ISBN: 9780309070362.

Chang, K.E., Y.T. Sung and I.D. Chen, 2002. The effect of concept mapping to enhance text comprehension and summarization. J. Exp. Educ., 71: 5-23.

Chiappetta, E.L., T.R. Koballa and A.T. Collette, 1998. Science instruction in the middle and secondary schools. Prentice Hall, New Jersey, USA., ISBN: 0-8016-1095-8, Pages: 632.

Chin, C. and D.E. Brown, 2000. Learning in science: A comparison of deep and surface approaches. J. Res. Sci. Teach., 37: 109-138.

Cobern, W.W. and G. Aikenhead, 1997. Cultural aspects of learning science. Sci. Literacy Cult. Stud. Project,

Cobern, W.W. and G.S. Aikenhead, 1998. Cultural Aspects of Learning Science. In: International Handbook of Science Education. Fraser, B.J. and K.G. Tobin (Eds.) Kluwer Academic Publisher, Dordrecht, Netherlands, pp: 39-52.

Cobern, W.W., 1994. Worldview theory and conceptual change in science education. Sci. Educ., 80: 579-610.

Gobert, J.D. and J.J. Clement, 1999. Effects of student-generated diagrams versus student-generated summaries on conceptual understanding of causal and dynamic knowledge in plate tectonics. J. Res. Sci. Teach., 36: 39-53.

Guolla, M., 1999. Assessing the teaching quality to student satisfaction relationship: Applied customer satisfaction research in the classroom. J. Marketing Theory Prac., 7: 87-97.

Hanrahan, M.U., 1999. Rethinking science literacy: Enhancing communication and participation in school science through affirmational dialogue journal writing. J. Res. Sci. Teach., 36: 699-717.

Hofstein, A. and R. Mamlok-Naaman, 2007. The laboratory in science education: the state of the art. Chem. Educ. Res. Prac., 8: 105-107.

Hoftein, A. and V.N. Lunetta, 2004. The laboratory in science education: Foundation for the 21st century. Sci. Educ., 88: 28-54.

Hughes-Freeland, F., 1998. Imagining Indonesia: Cultural politics and political pulture. J. Asian Stud., 57: 1229-1231.

Maddock, M.N., 1983. Research into attitudes and the science curriculum in papua New Guinea. J. Sci. Math. Educ. Southeast Asia, 6: 23-35.

Maehr, M.L. and C. Midgley, 1991. Enhancing student motivation: A schoolwide approach. Educ. Psychologist, 26: 399-427.

Midgley, C., 1993. Motivation and middle level schools. Adv. Motivation, Achiev., 8: 217-274.

Mohamed, N. and Z.H. Ismail, 1997. Attitudes of 1st year chemistry under-graduates towards CAI. J. Sci. Math. Educ. Southeast Asia, 20: 13-19.

Musheno, B.V. and A.E. Lawson, 1999. Effects of learning cycle and traditional text on comprehension of science concepts by students at differing reasoning levels. J. Res. Sci. Teach., 36: 23-37.

Ogunniyi, M.B., O.J. Jegede, M. Ogawa, C.D. Yandila and F.K. Oladele, 1995. Nature of worldview presuppositions among science teachers in Botswana, Indonesia, Japan, Nigeria and the Philippines. J. Res. Sci. Teach., 32: 817-831.

Olson, J. and J. Platt, 2000. The instructional cycle. Teach. Children, Adolescents, Spec. Needs,

Rejskind, G., 2000. TAG teachers: Only the creative need apply. Roeper Rev., 22: 153-157.

Schunk, D.H., 1984. Self-efficacy perspective on achievement behavior. Educ. Psychologist, 19: 48-58.

Shumba, O., 1999. Relationship between secondary science teachers' orientation to traditional culture and beliefs concerning science instructional ideology. J. Res. Sci. Teach., 36: 333-355.

Tappan, M.B., 1998. Sociocultural psychology and caring pedagogy: Exploring Vygotsky's "Hidden Curriculum". Educ. Psychologist, 33: 23-33.

Vygotsky, L.S., M. Cole, V. John-Steiner, S. Scribner and E. Souberman, 1978. Mind in Society: The Development of Higher Psychological Processes. 14th Edn., Harvard University Press, Cambridge, MA., USA.