

A Framework for Dropout Monitoring and Management System

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ABSTRACT

Dropping out of school has economic and social implications on the dropouts and the society at large. Being a global problem, efforts of researchers on the causes, effects, preventives and control methods are well documented in the literature. However, despite these efforts, the world is still witnessing unacceptable rate of school dropouts. The National Dropout rate in United State is 8.1% , that of the foreign borns is 20.7%. Though, there is no coordinated dropouts figure in Nigeria, that of South Africa is 40%. Presently, in Africa, issue of dropouts is not receiving enough attention of the people and government. It is being viewed as the problem of the victims and their families. Hence, available researches on the subject matter are international. The techniques and findings reported cannot therefore be generalized or directly adopted in Nigeria for societal, cultural, social, and political diversities. This work presents a conceptual framework for dropout monitoring and control in Nigerian Universities. Theories of Attribution, Social- Capital, and Engagement provide the bases for the design. The causes, prevention and control components of the framework are explained. The significance of the Early Dropout Warning and Control subsystem is stressed and techniques for its realization are also explained. On implementation, the dropout risk factors in Nigeria shall be determined and the most appropriate Data Mining and Artificial intelligence techniques for the subsystem shall be discovered. Also, the acceptability and effectiveness of the system shall be evaluated. Inferences drawn and the lessons learnt shall form the basis for further recommendations and future works.

Keywords: Droppouts, Management, Monitoring, Framework, System & Education.

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1. INTRODUCTION

The phenomenon of School Dropouts is a global tragedy, a silent epidemic that must be contained before it becomes endemic. Dropouts occurred when student fail to succeed academically, faded over time, pushed out by the school or left for life events, (Balfanz, 2007). The term commonly refers to persons who leave school for any reason, except death, before completion of high school (Canty & Fritz, 2014). Though, the patterns of dropouts vary by countries and causes of the scourge also vary at the Primary, Secondary and Tertiary levels of education, but, the consequences are similar. Causes of dropout as categorised in Battin-Pearson et al. (2000) are general deviancy, deviant affiliate, family socialization, structural strain and academic quandary. Dropouts have grievous psychological, social and economical implications. The effect of dropouts include their prevalence in some rapidly growing racial/ethnic disorders, they earn less and contribute low tax to the economy, they draw up criminal justice cost and draw heavily on welfare and public assistance (NEA, 2008). Similarly, Dropouts are far more likely than graduates to be unemployed, underemployed, imprisoned, divorced, niggling and live below the middle class. Looking at its consequences on the educational institutions, dropouts have direct link to loss of target revenues, low actualization of mandates and negative societal perceptions. Some schools have been branded “Dropout industry” to portray their incapability to process students to graduation. Dropout should be the concern of all, because, when a student drops out of school all members of the society bears the consequences directly or indirectly.

Recently, the world is witnessing unacceptable rate of school dropouts. In the 2012/13 school year, about 60 students dropped out of a Washington high school each day (Nelson, Hubaert and Grunenfelder, 2014). Also, the National Dropout rate in United State as reported in NCES (2016) is 8.1% , that of the foreign borns is 20.7%. South Africa has an alarming rate of University dropouts of 40% (Andre, 2015). Though, no coordinated figure for dropouts from various levels of education in Nigeria, however, it was reported to be between 5% and 70% across the various level of education. Precisely, a UNESCO report in 2013 showed that the rate of dropout for the primary level was 42%. Having realised the danger of this problem, developed countries researched into the causes of dropouts, the prevention techniques and control measures, consequently, several initiatives were formulated and implemented. Unfortunately, in Africa, especially in Nigeria, the government and the society are not giving this terrible problem the weight of attention it requires. Largely, dropouts are viewed as personal loss to the victims and the affected families. This perception needs to be corrected and adequate operational structure need to be in place to manage the menace.

Prominent initiatives to minimize dropout in the developed countries and in few African countries include the University of Colorado's three elements dropout prevention framework Canty & Fritz (2014) , the Clemson University's five phases framework for a national dropout prevention centre (Wilkins, J., and Huckabee, S., 2014). and the five factors based framework developed in Wallace (2016) at the Walden University. Another is the USAID sponsored pilot initiative which was built on introduction of early warning system and student engagements interventon. None of these frameworks could be appropriate for direct adoption in Nigeria. For instance, most of them identified Early Alarm System as an important component of Dropout Management Framework. In the few cases where the implementation techniques for the framework were reported, it was just the existing institutional operational units that were strengthened for the realization. To achieve such in Nigeria would require a purposefully built automated subsystem that must be integrated with existing operational units. This is largely because the available processes and resources are mostly inadequate for proper monitoring of large students' activities for any meaningful proactive intervention.

So, considering the fact that most of the available researches on the subject matter are international, the techniques and findings in the literature cannot be generalized for societal, cultural, social, and political diversities. Furthermore, the theoretical bases on which the initiative are built were not also reported in the literature. It is essential therefore to develop a conceptual model hinged on standard Educational Psychology theories for investigating the pattern of dropout in Nigerian Universities, the causes, feasible preventive measures and control techniques. This is the crux of this paper. Subsequent sections summarises some of the global efforts that have been made to reduce dropouts. From the indices identified in these related works and the clues from relevant Educational Psychology theories, a conceptual framework for Dropout Early Warning and Control System in Nigerian Higher Institutions is proposed. The components of the framework are explained and the intended processes of implementation are described.

2. REVIEW OF EXISTING DROPOUT PREVENTION FRAMEWORKS

The causes of dropout identified in a survey designed to harvest the perspectives of high school dropouts sponsored by the Bill & Melinda Gates Foundation Bridgeland (2006), include boring classes, lack of motivation to work harder, academic challenge and personal reasons. Some of the personal reasons are the need to make money, care for family members and becoming a parent. The prevention techniques suggested include improved instruction, provision of access to support and building strong relationship with at least one adult. Others are improved parent / school communication and early warning system. The suggested control measures are parent engagement strategies and individualized graduation plans. Shahrina et al. (2012) identified the inappropriateness of ascribing students' academic achievement to intelligent / cognitive level alone. They identified other factors such as self efficacy, support system and socio-economic factors. A theoretical framework was developed for an exploratory study to examine these contributing factors to low academic achievement.

Canty & Fritz (2014) developed a research based strategy to promote students engagement by building Colorado Dropout Prevention Framework. The three essential elements of the framework are identification, institutional change, and intervention and support. Twelve (12) items grouped into 4,4,6 overlaped methods and tactics were identified for the three elements respectively. For the Identification elements, the methods are Data Analysis, Early Warning Systems, Tracking of School Youth and Assess School Climate. The Institutional change element has Enhanced School Climate, Policies and Practices Review, Community Engagement and Family Involvement as its methods. Also, methods for the Intervention and support are Community Engagement, Family Involvement, Transition Programs, Multiple Pathways to Graduation, Reengagement of out of School Youth, Enhanced Counseling and Mentoring and Credit Recovery Options.

The United State Agency for International Development –USAID (2015) sponsored a program called School Dropout Prevention Pilot (SDPP). The intent of SDPP Program was to identify best practices in dropout prevention in the U.S. and developing countries; to analyze dropout trends, policies and programs, and factors and conditions affecting dropout in each country. It was also to design, implement and rigorously assess the effectiveness of interventions to prevent school dropout using randomized control trials. Based on its experience, SDPP generated evidence and guidance for use by USAID and ministries of education on ways to decrease dropout and address the behaviours that put students at risk of dropping out. In a pilot program that was implemented in 2015, by Creative Associates International with international partners Mathematica Policy Research (Mathematica) and School-to-School International (STS), and local partners Kampuchean Action for Primary Education (Cambodia), QUEST Alliance (India), and CARE International (Timor-Leste). In collaboration with ministries of education and through consultation with stakeholders, SDPP introduced an Early Warning System (EWS) and a student engagement program as intervention to address dropout.

Wallace, (2016), observed that the existing dropout prevention plans are inappropriate because they focused on academic issues alone. They therefore built a conceptual framework that was based on five factors of general deviancy, deviant affiliate, family socialization, structural strain and academic quandary. The aim was to determine experiences that cause students to dropout and suggest strategies for a new dropout prevention plan. The causes identified are behavioural issues, peer and work related influence, family structure, school environment and academic problem. The prevention techniques suggested include Tutoring, staff development, mentoring, counselling, parental involvement, teenage mother programs and alternative options.

For easy referencing and in line with the proposed conceptual framework, the causes of dropout, the available prevention and control methods are summarized in table 1.

Table 1: Harmonization of the causes, prevention and control methods for students' dropout.

Author	Causes		Prevention Methods	Control Methods
	Internal Factors	External Factors		
Hart (2005)	lack of motivation to work harder; academic challenge	Boring classes; need to make money; care for family members and becoming a parent.	Improved instruction; provision of access to support; building strong relationship with at least one adult; improved parent / school communication and early warning system.	Parent engagement strategies and individualized graduation plans.
Shahrina et al. (2012)	Self efficacy	Support system and socio-economic factors.		
Canty & Fritz (2014)			Early Warning Systems; Enhanced Counselling and Mentoring; Enhance School Climate; Policies and Practices Review; Family Involvement.	Community Engagement, Transition Programs, Multiple Pathways to Graduation, Reengagement of out of School Youth, and Credit Recovery Options
USAID (2015)			Early Warning System (EWS)	Student engagement programs
Wallace (2016)	behavioural issues, academic problem	Peer and work related influence, family structure, school environment	Tutoring, staff development, mentoring, counselling, parental involvement, teenage mother programs and alternative options.	

3. THEORETICAL FRAMEWORK –

3.1 Supportive Theories for the Framework

3.1.1 Attribution Theory

Attribution Theory is a social psychology theory promulgated by Fritz Heider in 1958. It is a method for making causal explanations of behaviours. Causal attributions determine affective reactions to success and failure (Weiner, 1986). The three-stage process used in Attribution Theory is Perception, Judgement and Attribute. At the Perception stage, a person must be perceived or observed for the behaviour. The Judgment stage determines the deliberateness of the action for the purpose of Attribution. Attribution determines whether the behaviour is caused by the internal/situational or by external/dispositional factors. The three causal dimensions for classifications of attributions are locus of control, stability, and controllability. The locus of control dimension could be internal or external pole, the stability dimension captures whether causes are stable or unstable while controllability differentiate causes within or outside the control of the actor. An example of controllable causes is skill or efficacy. On the other hand, aptitude, mood, others' actions, and luck are examples of causes over which actors have little or no control. The Attribution Theory states that all behaviour is considered to be determined by either internal or by external factors. In External Attribution or Situational Attribution, the actor feels not responsible because causality is assigned to an outside factor, agent or force. Conversely, in Internal Attribution or Dispositional Attribution causality is assigned to an inside factor, agent or force.

Actors feel responsible because of the controlling capability he has over the actions. Attribution theory is applicable to various areas of human endeavours, such as Psychology, Criminal Law, Ethics, Decision-making and Understanding of Cognitive Bias. Other areas of application are Human Resource Management's appraisals and Education. Among other behaviours, the theory has been used extensively in the study achievements. The four basic elements of achievement are Effort, Ability and, Level of task and Luck (Weiner, 2000). Effort is an internal and unstable factor over which actors or the subjects can exercise a great deal of control. Ability is a relatively internal and stable factor over which the actors do not exercise much direct control. Level of task difficulty is also an external and stable factor that is largely beyond actors' control. Luck is the fourth element. It is also an external and unstable factor over which actors exercise very little control.

3.1.2 Social Capital Theory

Social capital theory is a conceptual extension of human capital theory, which is itself an abstract extension of the concepts of physical and financial capital. The theory asserts that the principal avenues of human capital enhancement are formal and informal schooling and job training. The relevant variables identified include socioeconomic status, family configuration and family interaction (Mark, Lionel and Glenn, 1992). The theory relates intellectual development to parental and sibling support and encouragement. Further explanation for the connection between family size and intellectual development is based on the dilution hypothesis (Blake, 1981). The hypothesis states that the more the children, the more parental resources are divided and hence, the lower the quality of output.

3.1.3 Theory of Engagements

The construct of engagement is central to most theories of school dropout (Archambault I., Janosz M., Fallu J., and Pagani L.S. 2009). The construct of student engagement which originates in part from Social Control Theory places a great deal of emphasis on individual feelings of attachment and belongingness to social institutions. Youthful antisocial behaviour is viewed as a breakdown of the bonds between the individual and society. Likewise, disengagement could result from a weakened relationship between the individual and educational institutions. The bonds in Social Control Theory are characterized by commitment, beliefs, attachment, and engagement. These theoretical elements have greatly influenced conceptualizations of student engagement in recent theories of dropout. In the Tinto's mediation model, school dropout was represented as an ongoing and unfolding process, in which goals and institutional commitments were together taken as the course of student engagement from the day of entry and onward. These two characteristics and their evolution are believed to influence a youngster's academic and social experience at school and, in unfavourable conditions, can eventually play a role in the decision to leave the system altogether.

3.2 The Conceptual Framework

The three components of the proposed conceptual framework shown in figure 1 are causes, prevention and control. The core theoretical bases for the framework are the Attribution theory, the Social capital theory and the Theory of Engagements. The three components are informed by the Attribution theory's three-stage process of Perception, Judgement and Attribute. The theory also clued the categorization of the causes of dropout into Internal and External. Based on the harmonization of causes identified in (Hart, 2005), Shahrina et al. (2012) and Wallace, (2016) respectively, the internal factors are behavioural issues, self efficacy and academic challenge, it is however important to include health/biological issues. Similarly, the external factors as summarized in table 1 are early attainment of responsibility status (parent, breadwinner etc), negative social-economic status. The social-economic status is one of the variables of the Social capital theory; others include family configuration and family interaction. Peer influence (deviant affiliate) and school environment (non-conduciveness, uncoordinated records and weak support).

The harmonized prevention methods are enhancement of school climate, policies and practices, provision of access to support, counselling and mentoring, improved Family/ school communication, alternative graduation path options and early warning system. These prevention methods are deducible from the theory of engagement's Institutional commitment and engagement. It is observable that early warning system featured predominantly, this is not unconnected to its significant central role as monitoring subsystem. In this era of explosive school enrolments amidst inadequate budgets, human and material resources, the early warning system seems to be the most viable option for tracking the vulnerability of student to dropping out of school. The control methods are parent and community engagements, individualized graduation plans, reengagement of out of school youth, and credit recovery options.

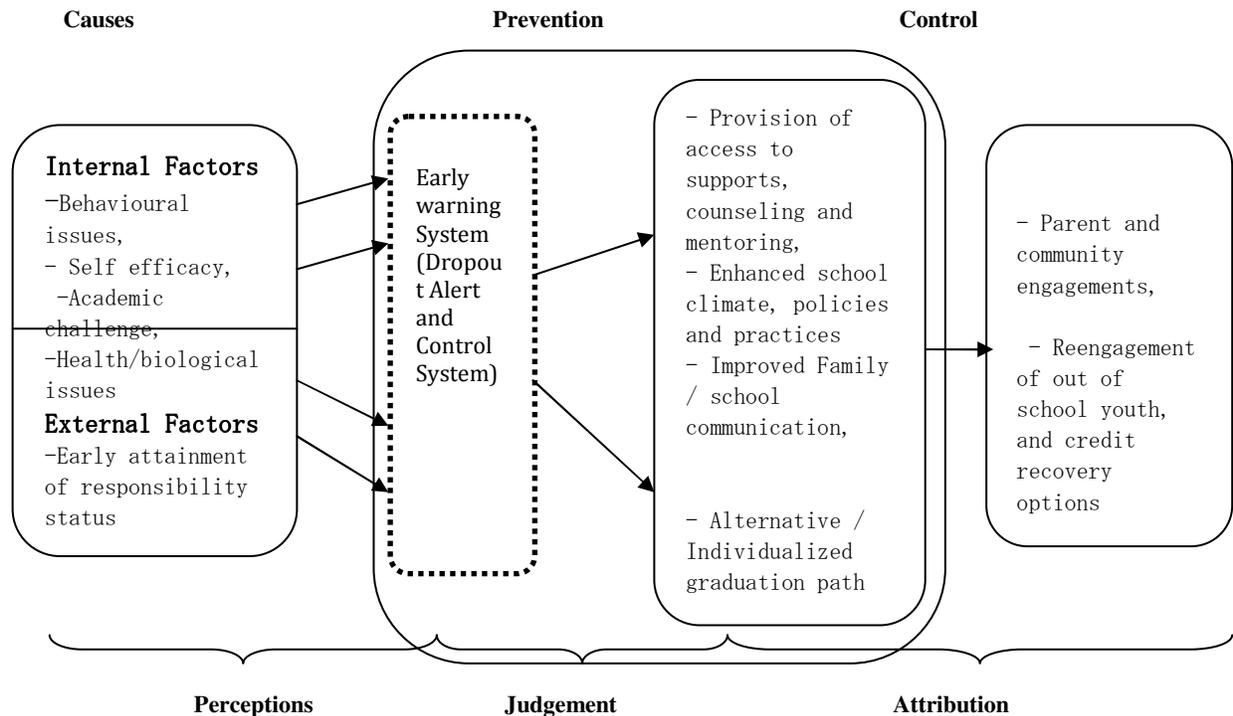


Figure 1: Proposed Framework for the Dropout Monitoring and Control System

3.2.1 Causes / Perceptions Component

The risk factors which could be categorised either as internal or external to the students, can be further classified to either be stable or unstable (stability) and either controllable or uncontrollable (controllability). Hence, behavioural issues, self efficacy and academic challenge are unstable and controllable, however, health/biological issues are unstable but uncontrollable. The external factors on the other hand are unstable and uncontrollable by the students. The categories of risk factors determine the choice of the preventive and control techniques to be employed.

3.2.2 Prevention / Judgement Component

Dropping out of school is often a process not a sudden event. So like a sinking boat, students often display the signs and symptoms of being in ‘trouble’ or having challenges which could eventually result to dropping out if not managed. Mostly, a given instance of dropout is usually caused by a single factor, though, there are rare instances of multi factorial dropouts. In either case, it is essential to identify the causes, classify them accordingly and recommend the most appropriate preventive measures. The framework abstracts a multi-input artificial intelligence system, built on historical data of the institutions to be studied.

During implementation, appropriate Data Mining techniques are to be deployed for data cleansing, data fixing and data analysis. A Neurofuzzy (Fuzzified Artificial Neural Networks) model shall be built and trained by the historical data. The developed network model shall have a central control unit linked to the various data sources like the Clinic for health records, Safety unit for security records and Academic units for grades and behavioural information. The overall system architecture is as shown in figure 2:

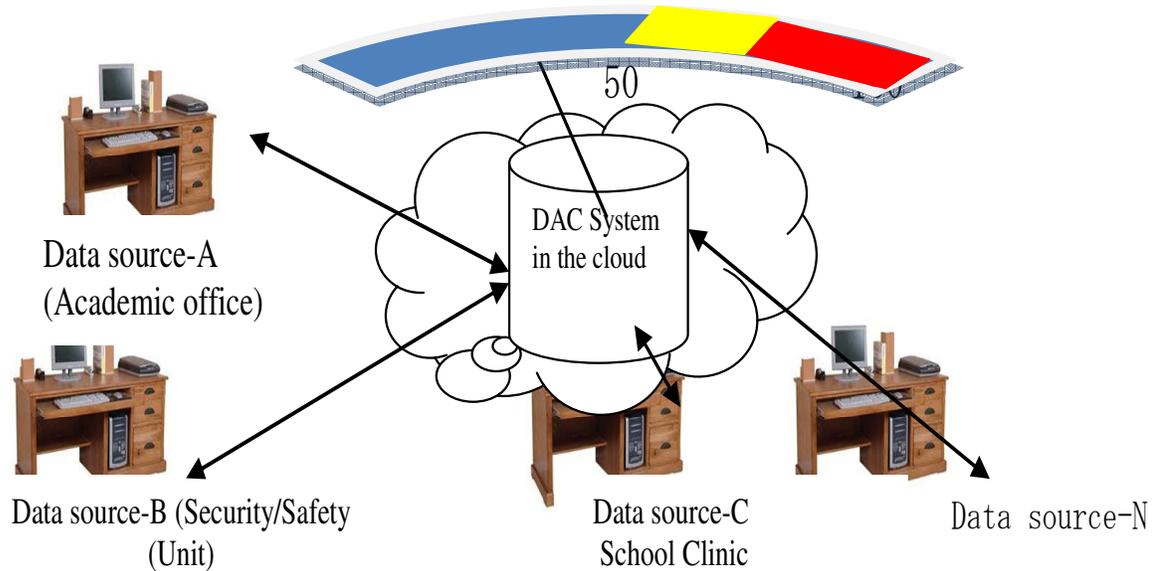


Figure 2: Architecture for Dropout Alert and Control (DAC) System

The architecture displays the integration and relationship between the various data sources, the monitoring system and the risk indicator in the students' portal for self monitoring. The dropout risk values 0 to 50 is indicated to be normal (blue), 51 to 70 is low risk (yellow) and 71 to 100 is high risk (red).

The Guidance and Counselling (G&C) units of the Institution shall have access to all student at risk. The system shall automatically recommend the most appropriate preventive measures for the at risk students. The G&C unit are to coordinate the provisions for support programmes such as family engagement, mentoring and tutoring, individualized graduation plans, reengagement and credit recovery.

3.2.3 Control / Attribution Component

The control component abstracts the last mile techniques to provide safe landing for the dropouts. All relevant stakeholders are required to provide necessary intervention to rescue the dropouts. Depending on the causes or attribution for the dropout, the school, the parent and members of the larger community need to put appropriate intervention programmes in place to get the victim back to school.

If the dropout is caused by internal factors then a lot of guidance and counseling might be necessary to reorientate the mindset of the victim. However, if it was a result of external factors, then the causative agent must be addressed properly. Very importantly also, is appropriate policy of relaunching the schooling process from the last good academic status.

4. FUTURE WORKS

Realization of the proposed framework shall be the next target. Nigeria Universities shall be the population of the study. Three Universities shall be selected with a representation from the Federal, State and Private categories. The process would include acquisition of historical data, model designing and training. The dropouts in the Universities shall be clustered into the four categories of academics, faded over time, pushed out by the school or left for life events. Their ratios shall be identified and discussed. Integration of the model to the existing student portals would avail all active students the opportunity view and monitor their dropout risk level. The G&C unit would be able to identify vulnerable students and place them on adequate safety/support programmes. At the various levels of development and implementation continuous evaluation and review shall be made using Spiral Software Engineering approach. Successful techniques and findings shall be presented at seminars and conferences. Stakeholders (staff, students, parents and management) perceptions of the programme shall be sought in questionnaires and interviews. These responses shall be analysed and used for operational enhancements. The overall success of the project shall be by comparing the initial number of students at risk and actual number of dropouts at the end of the operational session.

REFERENCES

1. Andre V.Z. (2015). South Africa's Alarming University Dropout Rate; News24wire; Retrieved from www.businessstech.co.za.
2. Archambault I., Janosz M., Fallu J., and Pagani L.S. (2009), Student engagement and its relationship with early high school dropout, *Journal of Adolescence* Vol 32 pp. 651 – 670
3. Balfanz, R. (2007). What your community can do to end its drop-out crisis: Learning from research and practice. Paper presented at the National Summit on America's Silent Epidemic, Washington, DC. Retrieved from http://web.jhu.edu/CSOS/images/Final_dropout_Balfanz.pdf
4. Battin-Pearson, S., Newcomb, M.D., Abbott, R.D., Hill, K.G., Catalano, R.F., and Hawkins, J.D. (2000). Predictors of early high school dropout: A test of five theories. *Journal of Educational Psychology*, 92, 568-582.
5. Blake, J. (1981). Family size and the quality of children. *Demography*, 18,421-442.
6. Bridgeland J.M. (2006), **The Silent Epidemic**. Perspectives of High School Dropouts. A report by Civic Enterprises in association with. Peter D. Hart Research Associates for the Bill & Melinda Gates Foundation, Retrieved from https://docs.gatesfoundation.org/documents/the_silentepidemic3-06final.pdf
7. Cauty C., and Fritz P(2014). Research-Based Strategies to Promote Student Engagement. Office of Dropout Prevention and Engagement, http://www.cde.state.co.us/dropoutprevention/cgp_framework
8. Mark H.S., Lionel J. B., and Glenn D.I. (1992), Effects of Human Capital and Social Capital on Dropping Out of High School in the South, *Journal of Research in Rural Education*, Vol. 8, (1), pp. 75-87.
9. National Center for Education Statistics – NCES (2016). The Condition of Education 2016 - Dropout Rates , 144. Retrieved from <https://nces.ed.gov/fastfacts>.
10. National Education Association (2008), Preventing Future High School Dropouts An Advocacy and Action Guide for NEA State and Local Affiliates, Washington, DC. Retrieved from <http://www.nea.org/assets/docs/HE/dropoutguide1108.pdf>
11. Nelson R., Hubert M., and Grunenfelder D. (2014), Student Access to Dropout Prevention Efforts and Supports. Olympia, WA. Retrieved from <http://www.k12.wa.us/LegisGov/2014documents/StudentAccessToDropoutPreventionEfforts.pdf>
12. Shahrina M.N., Wan-Ahmad W.F., Nayan Y., Yahya N., Abdullah A., Abdul Rahman A., Ismail N, and Ahmad N.A. (2012), A Conceptual Framework in Examining the Contributing Factors to Low Academic Achievement: Self-Efficacy, Cognitive Ability, Support System and Socio-Economic. International Conference On Management, Social Sciences And Humanities 2012, Available from: <https://www.researchgate.net/publication/259470497> [accessed Feb 3, 2017].
13. Tinto, V. (1975). Dropout from higher education: a theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89-125.
14. United States Agency for International Development – USAID (2015), School Dropout Prevention Pilot Program, Retrieved from <http://schooldropoutprevention.com>
15. Wallace C.M. (2016), A High School Dropout Prevention Program for At-Risk Students, Walden University Scholarworks, Retrieved from <http://scholarworks.waldenu.edu/dissertations>
16. Weiner, B. (1986). *An Attributional Theory of Motivation and Emotion*, Springer Verlag, New York.
17. Weiner, B. (2000), Intrapersonal and Interpersonal Theories of Motivation from an Attributional Perspective, *Educational Psychology Review*, Vol. 12, (1).
18. Wilkins, J., and Huckabee, S. (2014). A literature map of dropout prevention interventions for students with disabilities. Clemson, SC: National Dropout Prevention Center for Students with Disabilities, Clemson University.