

The Role of Multiple Literacies in Developing Interdisciplinary Research

¹Sajjad Hussain, ²Muhammad Idris, ²Nosheen Faiz, ¹Nasir Ahmad, ²Maksal Minaz

1. Center for education & Staff Training, University of Swat

2. Abdul Wali Khan University Mardan

Received: January 7, 2016

Accepted: March 2, 2016

ABSTRACT

The classification of knowledge into different disciplines is not to distinct knowledge of one domain from the other as these are the parts of a whole but to make it easy, and to provide space for development and promotion of knowledge. Interdisciplinary research provides the opportunity to study different domains of knowledge from single perspective so that to reach to an eclectic picture of the phenomenon. Results showed that interdisciplinary research contributes a lot in promoting interdisciplinary faculty's relationships and joint ventures in exploring the unseen facts. Multiple literacies are powerful indicators in promoting interdisciplinary research culture and disciplinary literacy of faculty. Multiple literacy theory emphasize on the componential development of language development which is corner stone for multiple literacies. Faculty's literacy in Information Communication Technology (ICT), Statistics and critical thinking/ problem solving skills are foundational for multiple literacy of faculty.

KEY WORDS: Multiple Literacies, Interdisciplinary Research, Statistical Literacy, ICT

1. INTRODUCTION

Literacy is an umbrella term used for a variety of purposes and perspectives. In English literature it means familiarity, understanding, and communication of concept from a field of knowledge {Keefe & Copeland, 2011}. It was the late of twentieth century when it was understood as the ability to read and write. The ability and skill of reading and writing was widely accepted as an indicator of the literate person in one or more fields of knowledge (concise oxford advance learner dictionary). According to Educational Testing Service {2009} literacy is more than just reading and writing, it includes understanding of documents quantitatively and qualitatively. In present advance technological world literacy is meant the competence of understanding and dealing the situation carefully and effectively with some reasonable knowledge of a field or some fields of knowledge. It includes the ability of critical thinking, problem solving, and the use of advance technologies {Kellner, 2012}. Literacy can be understood from different perspectives; such as literacy as skill, as applied practices, as a learning process and as a text. Literacy as a skill is the mixture of different skills such as reading, writing, and access to knowledge, information, and numeracy {Keefe & Copeland, 2011}. All these skills are considered as the fundamental skills that a literate person may have to possess. As applied practices, it is the practical application of developed skills as mentioned-it also includes the usage of those skills in different socio-economic context. In this regard first effort was made in 1960 when the term of functional literacy was introduced {Kagitcibasi, Goksen, & Gulgoz, 2005} which is the ability to use reading, writing and numeracy skills for effective functioning and development of the individual and the community

Literacy as learning process is a continuous learning process. It aimed at lifelong learning and includes learning of computer, media, multi-text, health, and environmental. Lifelong learning is a constructivist approach where the concentration is made on the life experiences at adult level, while at child age the school and home activities and interaction play the role in educating the individual in a continuous process {Lewis, & Fabos, 2005}. Literacy as a text relates it to the subject matters, including books, newspaper, magazines and other text materials imparting by the literate individuals to illiterate ones. It varies in nature that's the general text which covers educational/academic, professional, social, and linguistic {UNICEF, 2005; Matsuura, 2006}. Language provides foundation for all sorts of literacies. The knowledge and understanding of language enable the individuals to become literate with the basic concepts and themes of any field of knowledge. According to sociolinguists' literacy is more than just information sharing; it includes language,

* **Corresponding Author:** Sajjad Hussain, Center for education & Staff Training, University of Swat.
sajjadhussain@uswat.edu.pk

text and also non-language aspects of the society. It also covers the dress, body language, social, cultural and religious values and beliefs of a society {Street, 2005}.

With the passage of time and the developments made through science and technology increased the needs of the human being to be more knowledgeable and competent. The desire of knowledge and skill development made the field of literacy as wide as the choice of human beings. Apart from the enthusiasm of human beings for knowledge the close interdependence of different fields of knowledge compel the human beings to have more knowledge and information regarding different field of knowledge {Kellner, 2012}.

The New London Group comprises ten academicians from USA, UK and Australia. They have worked on the theoretical framework on the connections of the changing academic role of academicians where their approach to research is going to be broad day by day. Competence in field of knowledge can help to explain single perspective of a phenomenon as a result the findings of the study provide an incomplete picture. Therefore multiple literacies of researchers could help them in doing a holistic investigation. Sheridan-Thomas (2007) defined multiple literacy as the ability of an individual to read, understand and write critically in variety of situation with various angles which includes different printed materials (books, magazines, newspapers and publication) and non-printed materials (songs, movies and music). It also includes; digital, computer, language, statistical, media and critical literacies {Larson, Landers, & Begg, 2011}. The impulse to reply the “what” of multiple literacies is very crucial and useful. It deals with viewing literacy in socio-cultural constructs. It is the multi-cultural identity and the use of literacy in different social settings to come up with holistic view of the situation.

The basis of the classification of multiple literacies is not only based on different fields of knowledge (Sciences and humanities-mathematics, statistics, computer science and arts) but it can also be classified on the basis of medium, which includes print, image, page and screen. All these classification aims at the in-depth understanding of the concept of situation/concepts/themes and ways of life. The most important classification is the classification by fields of knowledge or disciplinary approach which gives an insight into that particular field or discipline {Street, 2005}.

2. Multiple literacy theory

Deleuze was the proponent of multiple literacies theory (MLT). He proposed a mixed approach in literacies which includes quantitative and qualitative description. It is the conceptual integration of innovative tools in learning process. The foundation of MLTs is language-oriented structure of learning. It validates the multi-dimensional needs of the present learner, and opens a new plate forum for language literacy. According to Deleuze language is foundation for other types of learning {Masny & Cole, 2009}. Before Deleuze different attempts have been made in literacy and its wide conceptual understanding. New London Group work on Multiliteracies work and according to them it is to incorporate different ways that illustrates the change point of views on literacy. According to them our current societies are multicultural and it is the reason that we need more thorough and conceptual understanding of literacies that could cover all the important aspects of our lives {Masny & Cole, 2009}.

According to there are three main elements of MLTs. First it concentrates on the opportunity of transformation of language and culture through social institutions. These institutions are the main channels for the preservation and promotion of language and culture. The constraints or difficulties that these institutions face due to financial, social and political aspects can be easily controlled through the teaching of multiple literacies. Second it provides an opportunity to understand the learning process on phenomenological experimental perspectives, for example it attempts to analyze the learning situation from the perspectives of its effects on the learners not on the subject. It concentrates on the situational learning and adaptive nature of the learner; it increases the adjustment of learners. In other words this approach to learning situations increases the chances of conceptual and practical experimentation of learners with learning situation and material. The improvisational approach of MLTs generate more interactions on the part of teachers and students, it attempt to make the learner more adaptive, because context is by nature dynamic and therefore it is important to be productive and adjusted. This further motivates the learner to learn and adjust in multiple contexts {Masny & Cole, 2009}.

3. Interdisciplinary research and multiple literacies

Larson, Landers, and Begg {2011} studied interdisciplinary research where emphasize is made on the nature of interdisciplinary research implementation and its necessary pre-requisites. An assumptions made by majority that anyone can do it, but its not true, as according to a wide range of literature interdisciplinary

research needs competence of the research in the basic field knowledge which develop the fundamental literacy in that particular field of knowledge. Sociology, education, political science, economics and history are inter-related fields of study. Experts in these areas have the opportunity to work together in the field of research and to take benefits from each other. Research in education is incomplete without history, sociology and economics, but political science provides policy background to education, all these shows the in-depth study possibilities in this interdisciplinary research culture. Research collaborations in interdisciplinary areas can contribute a lot. Department structures, contradictions of school of thought and fundamental knowledge regarding the field knowledge are the main barriers in the implementation of interdisciplinary research {Larson, Landers, & Begg, 2011}.

Interdisciplinary research has positive effects on the research culture in higher educational institutions. As higher educational institution's faculties have specialization in one specific field of knowledge and is therefore confine to one field. As a result they have weak inter-faculty relationships and are unable to benefit from one's another expertise, therefore it not only help the faculty to have strong inter-faculty relations but also provide an opportunity to their understanding in more than one discipline. Workshops, trainings, conferences on interdisciplinary research could further play a dominant role in this regard {Conole, Scanlon, Mundin, & Farrow, 2010}. Apart from this a collaborative working place in universities where experts of different disciplines could work together on the issues of common interest. The introduction of an interdisciplinary discipline will be a great step which can develop strong connections among different disciplines and can bring different specialists into one platform {Olson, 2011}. Facilities and incentive in-term of promotion and prestige to researchers working in interdisciplinary could also attract experts and can contribute into the development of this culture in higher educational institutions.

It covers a wide range fields which enables them in their social, cultural, religious and emotional life. All these literacies includes; media literacy, information literacy, critical literacy, affective literacy, medical literacy, statistical literacy, and technological literacy.

4. Literacy of ICT

Information Communication Technology (ICT) is the main element available at every point of the present life. No aspect of the current age is free from the influence of ICT. It has facilitated every aspect of human life from a small to sophisticated level {Stewart, 2009}. Our teaching learning process, curriculum development, management, planning and examination system are the aspects of education in general and research investigation in particular. The knowledge and skill of ICT facilitates the researcher at every step of their investigation. The collection of materials for literature review, data collection, instrument development and dissemination of the finding of the study to the world and its relevant stakeholders using internet, software's and other sophisticated ICT equipments support the researchers. A person knows a lot in other field of knowledge but cannot understand, use and correlate ICT to their field is considered as an illiterate person in ICT {Sheridan-Thomas, 2007}. There is frequent need to understand and use ICT properly for different tasks such as for research writing, for gathering information regarding different fields of life, for dissemination information for others, and for teaching learning process. The new and advance trends in computer should also be pursue to further develop our selves and works. It should also be use for culture promotion and preservation in the world community {Kaffash, Kargiban, Kargiban, & Ramezani, 2010}. Gathering and disseminating information is not enough for computer literacy but it actually covers a wide range of areas. It includes the basic technical skill of the use of computer, software, hardware, reading, writing, scanning, using multimedia, and scrutinizing the collecting information to use in some new and complex situations.

5. Statistical literacy

We count, multiplies, subtract and add everyday every movement. From simple ordinary home work to high complicated calculation in our businesses. The knowledge of numeracy/use of numbers for certain purpose, make a person statistical literate. According to Gal {2002} statistical literacy is the ability to interpret, critically evaluated and discuss or communicate statistical data/information to support its reasoning. Two main classifications have been made by Gal; the ability of understanding and critical evaluation of statistical information and the aptitude to discuss and communicate the statistical information. Watson and Callingham {2003} cited the definition of {Katherine Wallman, 1993};

Statistical literacy is the ability to and critically evaluates statistical results and permeates our daily lives-couple with the ability to appreciate the contributions that statistical thinking can make the public and private, the professional and personal.

The difference between them is the context, one represents general phenomena and the other was related the statistical literacy with specialized contexts. Gal {2002} described the basic components of statistical knowledge which is one component of statistical literacy were;

1. Understanding why the data is needed and how it could be produced
2. Understanding of the basic concepts and themes of descriptive statistics
3. Understanding of the basic concepts and themes of inferential statistics
4. Understanding the concept of probability
5. Understanding that how statistical conclusions and inferences are made

Mathematical knowledge based, knowledge related to the world (contextual knowledge), critical thinking skills, interactions of knowledge bases constituted the knowledge base of the statistical literacy model. For a statistical literate individual the knowledge of these five knowledge bases is not enough but he/she is expected to activate for practical participation in statistical discussions. Disposition reflects three major areas; critical stance, beliefs and attitudes, all these together generate stimuli for action {Gal, 2002}. Keeping in view the specialized context of statistical literacy it can be correlated to researchers' empirical and descriptive investigations in multiple disciplines, as researchers carried different correlational, longitudinal, cross-sectional, and experimental research studies. They collect data for measuring the relationship, investigating the effects/impact and the causes of some problems. Researcher needs to present the data in numerical form and to explain the results with the help of different inferential and descriptive statistics {Watson & Callingham, 2003}. There are different types of data (nominal, ordinal, interval and ratio) which demands for different type of statistical tests. The knowledge and understanding of a researcher on these basic statistical tests are indispensable for the researchers, because applying a wrong test could lead to wrong findings.

The model of statistical literacy presented by Gal {2002} is limited only to literacy skills, mathematical and context knowledge, critical questions and beliefs which ignored the ability of data consumers and data producers-furthermore it also neglected the usage of statistical data for making decisions. Multiple literacies here provide a bonding role in connecting it with social, educational, psychological and lingual aspects to reach to sound decisions.

6. Critical literacy

The world is made of multiple realities according the qualitative researchers. It is therefore important to explore the world from different angles. A person with bookish knowledge is a limited one till the time that he/she uses that in some proper context and environment. Critical thinking is the property of the intellectual persons of the society. They deal the situations creatively and critically using the knowledge and skills of different disciplines. Interdisciplinary research relations contribute into the development of faculty's relations and mutual understandings. The expertise of one discipline could help in understanding the other one {Stewart, 2009}. As an approach it needs more resources, time and food for taught than a single or one discipline but on the contrary its contributions are also greater, as it enhance the value and worth of work where a single phenomena from studied and understand from different perspectives. In some other words interdisciplinary research is a scientific approach of studying an area from different angles in an integrated manner {Tait & Lyall, 2007}. Critical literacy provides the opportunity to the process where the communicator is engaged in analyzing and criticizing what have been read and understand for the purpose to recognize the exact nature of the text and to take actions accordingly to promote and developed social equality and justice and also to contribute to the interdisciplinary knowledge {Gal, 2002}.

In order to develop critical literacy a group of experts have identified five categories or tools. It includes background knowledge, criteria for judgment, vocabulary of critical thinking, thinking strategies and mind habits {Case et al., 2004}. As interdisciplinary research studies complex problems and targeted the issues from a broad perspectives critical literacy help the researcher to investigate the research theme critically. This critical literacy aimed at the development of interdisciplinary relationships of faculty and solution to the problems which have no specific solution in one discipline. Trust, respect for other perspectives, optimistic and belief in change are the basics that can promote this approach in research. It develops the knowhow of one another discipline, enhance the co-operation among the faculty, discovers the similarities and differences which can be easily settled down {Halligen & Powell, 2008}.

7. Teacher education and multiple literacies

Teacher education has been remain conservative in the sense that it prefer to follow rather than to develop, which kept it a low developed and less flexible field for leading a change. In the heydays of the language and constructivist movement teacher education was studied from different angles to use it for leading the change. It is accepted that the recruitment of new teachers with new philosophical outlook, new dispositions and approaches to pedagogies can help to implement he determined agenda {Matsuura, 2006}.

Reforms in teacher education for multiple literacies faces the challenge of preparing pre-service teachers for the school as they are and as the might become. For this purpose they can adopt two ways first to plan for dealing the existing realities in school through establishing new pedagogical practices directly or to infiltrate accordingly with the passage of time. Second new teachers should study the model schools and classrooms where the multiple literacies, for the purpose to motivate them against the resistance they have to confront in their schools and classrooms. In nutshell there is need of efforts to implement the theory of multiple literacies in practice and to achieve the desired target which still needs rigorous efforts {Cervetti, Damico, and Pearson, 2007}.

In this current era focus is given to the reforms in teacher education as it is the change agent platform. Multi-directional knowledge and skills enable the prospective teachers to teach from different perspectives and to prepare the future nation in a broader way. Teacher education has the space for accommodating changes and updating itself with the requirements of the evolving world. Multiple literacy of teacher educators' not only enables the teacher educators to color the prospective teachers with the ink of future and on the other hand provide them the opportunity to carry research studies from interdisciplinary perspectives.

8. Teaching of multiple literacy in classroom

Teaching multiple literacies at different levels needs different considerations. At primary and elementary level there is always constant need of relating learning to social and cultural context. Classroom is a miniature society and all the major interactions that take place in the society take place within the classroom situation therefore it is important to relate the learning activities of day-to-day life {Lewis, & Fabos, 2005}. The teaching of multiple literacy at higher educational institution's level, is not an easy task and a separate department could help them in this regard. The use of different media in instruction that is using instructional technologies in the process of teaching increased students' familiarities with these technologies. The teaching of different languages in the class is another opportunity for teachers to link the relevant information on appropriate time and situation. Teaching from different perspective with an integrated approach across the curriculum will be beneficial for developing students' abilities. Apart from the formal subject teaching, teachers have to disseminate knowledge and information regarding health, environment, advance technological developments, local and international languages and the use of different important information resources.

Multiple literacy deals with the teaching of different disciplines to acquaint the learners with the learning of different skills and competence in order to achieve the targeted goals in time. It is the duty of the teacher to apply different strategies, methods for inculcating necessary information in the minds of students and to enable them to read the text and selected paragraphs with full comprehension. By multiple literacy students became able to gain more knowledge and skills from different sources particularly from authentic books as it reflects the minds of the great writers of the world. It is also imperative to increase their knowledge in all aspect of life to tackle the problems properly for the betterment of themselves as well as for the betterment of learning environment and larger system. By this way multiple objectives become result oriented and it also makes the teachers to get more knowledge and enhance their skills and competence {Mirabelli, 2005}.

Kist {2005} describes the implementation of new and multiple literacies in classroom settings where the students are familiarized with and are enable them to increase their understanding level about multiple literacies. He studied multiple literacies from different perspectives in classroom situation, from technological driven i.e. television, radio and other medias and from arts and social aspects i.e. from interdisciplinary interactions and aesthetical aspects. For instance, the efforts of a librarian, to transform library from a place of finding information to creating and dissemination of information through different media and channel, in the same way teacher can also redesign his/her practices to address the needs of students. Teachers can present materials through technology and can make efforts to minimize students' hardship in new literacies.

The use of internet in pedagogical practices is studied in the light of a framework developed by Leu, Leu and Coiro {2004}. There are five functions that are needed in understanding new literacies; 1st there is constant need of identifying curial questions, 2nd important sources of finding information, 3rd evaluation of

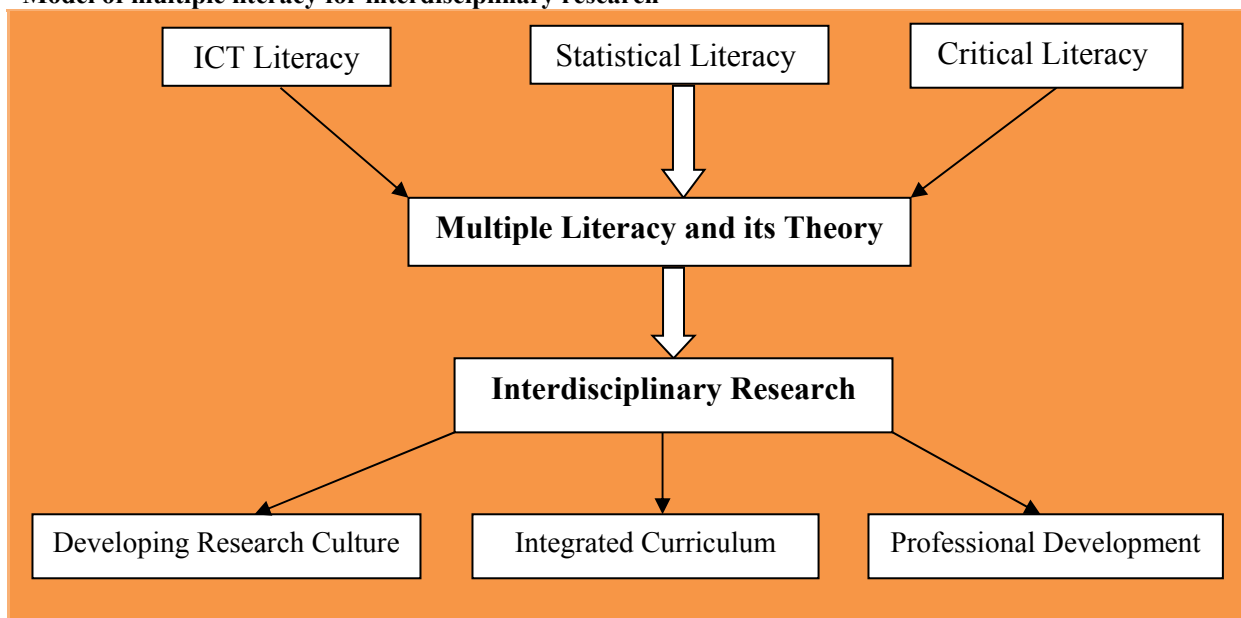
the information, 4th synthesizing information for answering the questions and 5th communicating that to the audiences. Apart from this framework teachers need to have understanding of time saving strategies, it contains on how to find relevant information, evaluate, synthesize and communicate properly.

9. Multiple literacies in practical world

Various attempts have been made to understand literacy from the perspectives of real life. Keefe and Copeland {2011} described literacy-as the process of documenting in every day practices. They employed the methods of ethnographic research in portraying literacies at home and society based programs. They considered multiple literacies more important in social and cultural context rather than in school scenario as these are the voluntary practices in which the adults and youth of the society use information, create and produce a variety of skills outside of school.

Literacies are actually socially constructed phenomena where new technologies have little influence and therefore increase the literate's knowledge and skills. We being human beings are effected from different interactions take place at social gatherings, media imparting information, use of computer in day-to-day lives, touch with internet and newspaper not only enhance the thinking capacity but enables the individual to understand various situations from different angles. This blended approach to lives reduces the chances of errors and help to live a happy and educated life, where the influences of schools are less than the overall practices take place in our social context {Cowan, 2005; Mirabelli, 2005}.

Model of multiple literacy for interdisciplinary research



Conclusion

Multiple Literacies is emerging trend in the field of education which is supportive for interdisciplinary research. All the dimensions of multiple literacies reflect its importance in our contemporary lives. The MLT emphasize on language development and its connections with critical thinking and problems solving abilities. Students of the 21st century not only need information and skills of reading and writing from printed and non-printed text but are also helpful for research studies which are the perspective of academicians and researchers in different field of knowledge. ICT literate researcher and academicians easily pursue their investigations as compared to those who are not competent in ICT.

Literacies in the 21st century are assessed on some determined criteria which make it easy to call an individual a literate or illiterate individual. The standards of NCTE, {2013} are mentionable and good to improve and assess individual's position. These standardize are the foundation and is the ultimate boundary and is therefore an indicator of success in the field of multiple literacies. To conclude there is need of specific baseline standards that could be utilized for not only assessing the level of multiple literacies but will also be used for enhancing it.

Statistical literacy is compulsory for daily routine work of daily life and it is just like blood of human body for researchers as they are always in need to analyze the data collected for research problems. The application of statistical tests, the understanding and interpretation of the results obtained from the test are important for the researchers. All the researchers of social and pure sciences department faculties need to be statistical literate, so that they could perform their relevant work in standardized manner. Concise numerical description of data with the help of statistics explains the side of the coin the qualitative interpretation of the results makes the findings of researcher complete. Laconically concluding that researchers multiple literacy in the guarantee of all round investigation of the facts.

The adaptation of multiple literacies in teacher education reduced the chance of incompleteness of preparing future teachers for their respective roles. Its implementation at class level and for connecting the separated faculties situated in their own compartments. To sum up multiple literacies is scaffolding for assisting interdisciplinary research, developing research culture and studying the world from an eagle view. Apart from them, with multiple literacy and interdisciplinary research integrated curriculum, faculty professional development and the development of research culture will be assured.

Empirical investigation is recommended for establishing the relationship between multiple literacies and interdisciplinary research and its impact on the developing research culture in higher educational institutions and building interdisciplinary faculty relationships.

REFERENCES

- [1] Case, R.; Falk, C.; Smith, N.; and Weiner, W. (2004). *Critical challenges across the curriculum*. Richmond, BC: Critical Thinking Consortium.
- [2] Conole, G., Scanlon, E., Mundin, P., & Farrow, R. (2010). *Interdisciplinary research Findings from the Technology Enhanced Learning Research Programme*. London: London Knowledge Lab Institute of Education University of London.
- [3] Cowan, P. (2005). Devils or angels: Literacy and discourse in low-rider culture. In J. Mahiri (Ed.), *What they don't learn in school: Literacy in the lives of urban youth* (pp. 47–74). New York: Peter Lang.
- [4] Cervetti, Damico, and Pearson, (2007). Multiple Literacies, New Literacies, and Teacher Education. *Theory into Practice*, 45(4), 378–386.
- [5] Educational Testing Service. (2009). *Types of literacy*. Retrieved March 19, 2014, from <http://www.ets.org/portal/site/ets/menu>
- [6] Gal, I. (2002). Adults' Statistical Literacy: Meanings, Components, Responsibilities. *International Statistical Review*, 1-51.
- [7] Halligen, P., & Powell, A. (2008). *Interdisciplinary research At Cardiff University Thinking Collectively About Complex Problems*. Cardif, UK: Halligen, P., & Powell, A. (2008). *Interdisciplinary research At Cardiff University Thinking Collectively About Complex Problems*. Cardif, UK: www.Cardiff.ac.uk/ir.
- [8] Kaffash, H. R., Kargiban, Z. A., Kargiban, S. A., & Ramezani, M. T. (2010). A Close Look In To Role Of Ict In Education. *International Journal of Instruction*, 3 (2), 64-74.
- [9] Kagitcibasi, C., Goksen, F., & Gulgoz, S. (2005). Functional adult literacy and empowerment of women: Impact of a functional literacy program in Turkey. *Journal Of Adolescent & Adult Literacy*, 472-489.
- [10] Keefe, E. B., & Copeland, S. R. (2011). What Is Literacy? The Power of a Definition. *Research & Practice for Persons with Severe Disabilities*, 36 (3), 92-99.
- [11] Kellner, D. (2012). *Multiple Literacies and Critical Pedagogy in a Multicultural Society*. Retrieved from <http://www.gseis.ucla.edu/faculty/kellner/>.
- [12] Kist, W. (2005). *New literacies in action: Teaching and learning in multiple media*. New York: Teachers College Press.

- [13] Larson, E. L., Landers, T. F., & Begg, M. D. (2011). Building Interdisciplinary Research Models: A Didactic Course to Prepare Interdisciplinary Scholars and Faculty. *Clinical and Translational Science* , 38-41.
- [14] Leu, D. J., Jr., Leu, D.,&Coiro, J. (2004). *Teaching with the Internet K-12: New literacies for new times* (4th ed.). Norwood, MA: Christopher-Gordon.
- [15] Lewis, C., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading ResearchQuarterly*, 40, 470-501.
- [16] Masny, D., & R Cole, D. (2009). *Multiple Literacies Thoery; A Deleuzian Perspective*. Rotterdam, The Netherlands.: Sense Publishers.
- [17] Matsuura, K. (2006). *Education For All Globle Monitering Report*. United Nations Educational, Scientific and Cultural Organization.
- [18] Mirabelli,T. (2005). Learning to serve; The language and literacy of food service workers. In J. Mahiri (Ed.), *What they don't learn in school: Literacy in the lives of urban youth* (pp.143-162).NewYork: PeterLang
- [19] Olson, S. (2011). *Science on FIRE: Facilitating Interdisciplinary Research and Education: A Practical Guide*. Colorado: American Association for the Advancement of Science.
- [20] Sheridan-Thomas, H. K. (2007). Making Sense of Multiple Literacies: Exploring Pre-Service Content Area Teachers' Understandings and Applications. *Reading Research and Instruction* , 46 (2), 121-145.
- [21] Stewart, J. (2009). Problems and opportunities of interdisciplinary work involving users in speculative research for innovation of novel ict applications. *Conference Proceedings of COST298 The Good, The Bad and The Challenging. The user and the future of information and communication technologies*, (pp. 1-13). Slovenia.
- [22] Street, B.V. (2005). Introduction: New literacy studies and literacies across educational contexts. In Street, B.V. (Ed.) *Literacies across educational contexts: Mediating learning and teaching*. Philadelphia, PA: Caslon Publishing. (pp. 1-2 1).
- [23] Tait, J., & Lyall, C. (2007). *Short Guide to Developing Interdisciplinary Research Proposals*. Edinburgh, England: The Institute for The Study of Science and Technology.
- [24] UNICEF. (2005). Girls' Education: Literacy. http://www.unicef.org/girlseducation/index_focus_literacy.html. (Accessed 15 March 2014.) across educational contexts. In Street, B.V. (Ed.) *Literacies across educational contexts: Mediating learning and teaching*. (pp. 1-2 1).Philadelphia, PA: Caslon Publishing.
- [25] Watson, J., & Callingham, R. (2003). Statistical Literacy; A Copmlex Hierarchical Construct. *Statistics Education Research Journal* , 2 (2), 3-46.