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From the Editor

Dear Readers,

This is the first of two issues for 2019 and it marks a new advance for the *IAFOR Journal of Education*: we are now indexed in Scopus. This means that the journal now has far reaching indexing being indexed with DOAJ, ERIC, EBSCO Discovery Service, Education Source, MIAR, TROVE, SHERPA/RoMEO, WorldCat and Google Scholar. Many people have been instrumental in bringing the journal to this level and I would like to thank Dr Joseph Haldane, CEO of IAFOR and Executive Editor; Dr Elena Mishieva, Publications Coordinator and Managing Editor; Nick Potts, Publications Manager; Dr Bernard Montoneri, former Editor; and Clare Midgley, former Publications Manager.

In this issue, we again demonstrate the multiplicity of fields that mark education. Within this issue there are papers on quantitative and verbal aptitudes as predictors of success; in-service teacher training and professional development; student success workshops for Hispanic students; science teaching, internationalization of higher education in Mongolia; learning transfer; and a model of knowledge sharing between teachers. We are sure that you will find food for thought and reflection, and the possibility of application in your own fields.

Just as the fields are diverse, our authors also come from several countries, demonstrating the international and intercultural nature of our journal. In this issue there are authors from Nigeria, Uganda, the United States, Mongolia/Japan, Canada, Macedonia, and the United Kingdom.

No issue of a journal moves to publication without the dedication of many people. I would like to thank my Associate Editors, Lynda Leavitt, Massoud Moslehpour and Raimond Selke, who support me in my role. I also thank the many reviewers who offer their service to the profession by volunteering to review the many articles submitted for each issue, providing constructive feedback to authors. These people are the backbone of the journal. Thanks also go to Elena Mishieva and Nick Potts who take the files and produce a finished product. Their work behind the scenes is invaluable.

We hope that you enjoy this issue of the *IAFOR Journal of Education* and consider sharing your own research and experiences in the journal. The next issue is due to be published on December 1, 2019.

Yvonne Masters
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Article 1: Quantitative and Verbal Aptitudes as Predictors of Senior Secondary School Students' Performance in Economics

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Article 2: In-Service Teacher Training and Professional Development of Primary School Teachers in Uganda

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Article 3: The Effects of Student Success Workshops on Undergraduate Hispanic STEM Students on the U.S.-Mexico Border

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Article 4: Exploring the Relationship between Science Content Knowledge and Science Teaching Self-Efficacy among Elementary Teachers

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Article 7: A Proposed Typology of Knowledge Sharing within Communities of Teachers: A Comparative Case Study Focusing on England and Macedonia

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**Quantitative and Verbal Aptitudes as Predictors of Senior Secondary School Students’
Performance in Economics**

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Abstract

This study examined the predictive power of quantitative and verbal aptitudes on the performance of senior secondary school students in Economics. The study arose from the poor performance of students in the Senior School Certificate Examination and the General Certificate in Education Economics. The study adopted descriptive survey research design. Multistage sampling technique was employed in selecting a total of three hundred and thirty senior secondary two Economics students from ten schools comprising of five private and five public schools. Data were gathered with three test instruments, namely the Economics Achievement Test, the Quantitative Aptitude Test and the Verbal Aptitude Test. The reliability coefficient was established using Pearson Product Moment correlation coefficient and was found to be 0.86 for the first test, 0.81 for the second and 0.93 for the last. Data were analyzed using ANOVA and multiple regression of the SPSS. The findings revealed that quantitative and verbal aptitudes have predictive power on the performance of senior secondary school students in Economics. However, quantitative aptitude has more predictive power ($B = 0.339$) than verbal aptitude ($B = 0.206$). Based on the findings, it is recommended that school authorities should provide learning materials that will promote the acquisition of quantitative and verbal skills; teachers should use appropriate teaching methods and promote high-order thinking and logical reasoning in the students; and government should recruit adequate and qualified teachers to teach Economics, quantitative and verbal related subjects.

Keywords: quantitative aptitude, verbal aptitude, predictor, economics performance.

Introduction

The essence of schooling is to provide learners the opportunity of acquiring requisite education and training that will enable them to adjust meaningfully in the society and contribute to the development of the nation. Education is a means for national transformation. Coetzee (2011) noted that the success of a nation's educational system is measured by the academic achievement of the students. Dambudzo (2009) opined that a lot of emphasis has been placed by the society on the academic achievement of its citizens for the past couple of decades (as cited in Coetzee, 2011). In fact, academic excellence remains the major index used to evaluate the quality of education offered in schools.

Ascertaining the academic achievement of students involves the determination of the extent to which they have benefitted from exposure to instruction and other academic tasks. This is done using different methods or techniques. The results from this measurement are useful in decision making.

The academic achievement of senior secondary school students is an important factor that determines their future academic pursuit. In Nigeria, the Senior School Certificate Examination (SSCE) – which is conducted by the West African Examinations Council (WAEC), National Examination Council (NECO) and National Business and Technical Examinations Board (NABTEB) – is a prerequisite for entry into a tertiary institution. To be considered eligible for tertiary education, candidates are expected to obtain at least credit grades in five subjects (especially for university admission) in the SSCE. Economics is one of the subjects offered in this examination. According to the National Open University of Nigeria (2006), Economics was first taken in the West African School Certificate Examination as a school subject in 1967. It further stated that the teaching of Economics as part of the Nigerian school curriculum probably started in 1966, after most other subjects had been introduced. Since the introduction of the subject in secondary schools, there has been an astronomical increase in the number of schools that teach it and the number of students that enroll for the examination. Economics is among the most popular subjects in secondary schools (National Open University of Nigeria, 2006).

The importance of Economics in any nation cannot be over-emphasized. It seeks to allocate scarce resources towards the satisfaction of unlimited wants. In other words, it seeks to address economic problems facing our society (Anyanwuocha, 2006). The economic changes in the world today require people who can cope with varying situations and adapt to harsh economic realities. With increasing economic problems, particularly in developing countries like Nigeria, the task is for citizens to be equipped with the skills that will enable them to move out of these situations and contribute to the development of appropriate policies aimed at mitigating the effects of these challenges. Adu, Galloway and Olabisi (2014) noted that knowledge from the study of Economics could provide solutions to economic problems. The teaching of the subject should reflect on development issues that occupy the minds of policy makers and business people considering that it deals with real-world economic systems (Ongeri, 2009). Therefore, Economic literacy helps to build better citizens who will emerge as good managers of their own resources and that of the nation. Besides, as a commercial subject, Economics is important to secondary school students desirous of studying commercial disciplines in the university and other tertiary institutions.

Economics has been witnessing poor performance in recent years, particularly in public examinations in Nigeria. An analysis conducted by Adu, Ojelabi and Hammed (2009) on the

West African Senior School Certificate Examination (WASSCE) May/June and Nov/Dec Economics from 1996 – 2005 revealed a sharp decline in performance. Alade, Nwadingwe and Igbiosa (2014) lamented that this poor performance has been an issue of great concern to the government, parents and well-meaning Nigerians. Although researchers have been examining factors responsible for this anomaly, not much attention has been paid to likely contributory factors, particularly verbal aptitude.

The need to investigate these variables (quantitative and verbal aptitudes) as likely factors influencing performance in Economics became necessary based on the assertion of Anyawuchi (2010) that Economics problems could be solved using three approaches which are quantitative, graphical and theoretical (as cited in Mawak and Wakdos, 2017). The theoretical approach has to do with the use of verbal language. It therefore means that to excel in Economics examination, candidates should demonstrate numerical and verbal abilities as well as mastery of the subject knowledge. Quantitative and verbal skills come into play because candidates are expected to answer computational questions, as well as present answers in a logical and analytical manner. Also, candidates are expected to use appropriate terms, draw relationships between concepts, and interpret information/data clearly. Cohen and Cohn (1994) argue that Economics students must present their economic arguments in a logical sequence using verbal and graphical forms (as cited in Nguyen & Trimarchi, 2010). This is in addition to the use of numerical language because the subject involves deductive and abstract reasoning (National Open University of Nigeria, 2006).

Quantitative aptitude refers to the ability to solve numerical problems (Adu et al, 2009). It means applying numerical and problem-solving skills in dealing with calculative tasks. This aptitude is needed by Economics students when responding to tasks or questions that have to do with mathematical and graphical presentation and analysis. Colander (2000) noted that introductory Economics is often perceived by students as being boring because they are not familiar with mathematical concepts (as cited in Onger, 2009). Similarly, Adu et al (2009) stated that the introduction of mathematical elements into the new Economics syllabus has posed serious problem for senior secondary school students due to their poor attitude towards mathematics. A lot of students have a phobia for figures which impacts negatively on their learning outcomes in Economics (Ayeni & Olasunkanmi, 2015).

Verbal aptitude encompasses the ability of a student to spell words correctly, use correct grammar, understand word meanings, understand word relationships and interpret detailed written information. Andrew, Cobb and Giampietro (2005) noted that verbal ability (or aptitude) is when a person is skilled at putting ideas into words, both in oral and written forms. Verbal aptitude facilitates the interpretation of information in a logical and analytical manner. Such ability helps in organizing words coherently (Andrew et al, 2005).

Some of the reasons why students fail examinations could be due to the inability to frame responses to questions and spell words correctly. Obe (1996) listed weakness in comprehension and the inability of students to express themselves, among others, as factors responsible for mass failure in examinations (as cited in Adeyimi & Adeyimi, 2014). Economics requires verbal skills as students are expected to analyze their answers, spell relevant terminologies correctly, understand concepts, give detailed explanation, among others.

The chief examiners' reports of the WAEC on candidates' performance in Economics tend to highlight the importance of quantitative skills (Eleje & Esomonu, 2018) and also verbal

skills. For instance, the reports for 2010 and 2012 May/June Economics pointed out the following weaknesses of the candidates:

- Poor grammatical expression: candidates could not express themselves in simple, clear and correct language;
- Scanty explanation: they merely listed the points without explaining them;
- Poor knowledge of drawing graphs and inability to carry out simple calculations;
- The use of wrong terminologies.

Adegbile and Alabi (2007) state that students' grades to a large extent, are associated with verbal ability. Lamenting on the poor language skill possessed by black South Africans, Stephen, Welman and Jordan (2004) reported a study conducted by Stanley (1998) at a tertiary institution in South Africa which showed that over 90% of black students lacked comprehension skills for successful completion of their courses. The success of students in an examination is greatly dependent on the ability to comprehend the examination questions and provide the required answers. Iyamu (2005) stated that most research on school improvement and academic achievement in Nigeria have not given adequate attention to verbal ability as a factor that most likely affect students' performance.

Information from this study is vital in shaping the teaching and learning of Economics at the secondary school level. Understanding the influence of quantitative and verbal aptitudes could help teachers in designing their lessons by using appropriate teaching methodologies that would simplify concepts considering the abstract nature of the subject and encourage students to develop higher-order thinking skills. Schools and the government could utilize findings from this study to invest more in academic tasks that would promote the acquisition of quantitative and verbal skills by the students.

Literature Review

Investigations into the factors affecting performance of students have dominated research in recent times. This is because the goals of learning or education can only be achieved when learners are doing well as evidenced by the level of their academic achievement. Efforts are constantly being made by researchers and educators to examine multiple-variables that influence performance in Economics. Studies have attributed performance in the subject to parents, schools, teachers, learning materials and students' characteristics such as emotional intelligence, interest, curiosity and aptitude.

Adesoji and Oginni (2012) in their study noted that students' aptitude is a factor responsible for poor performance. They lamented that studies have not paid adequate attention to students' aptitude while concentration has been on teachers, schools and the learning environment as variables responsible for this poor performance. Adeyemo (2010) recommended that the development of students' abilities (aptitudes) should be of great importance as it shows a high and positive significance in problem solving which also relates to effective learning and bring about high achievement. However, the aptitudes of interest in this study are quantitative and verbal aptitudes.

Adu et al (2009) argued that no student will do well in Economics without quantitative ability (or aptitude). In their study, which sought to determine the correlation between quantitative ability and achievement in secondary school Economics in Oyo State, Nigeria, they

concluded that any student who possesses good quantitative ability would perform better in any Economics examination.

Schuhmann, McGoldrick and Burrus (2005) conducted a study to determine the correlation between quantitative literacy and economic literacy of university students. Their findings showed that quantitative literacy is a very important determinant of economic literacy. They concluded that the ability to perform quantitative tasks would result in higher economic knowledge. Students without basic quantitative skills may find it difficult to understand and interpret economic concepts. Quantitative ability implies that students are able to separate concepts in its constituent parts (Eleje et al, 2018) and relate abstract concepts to various phenomena.

Bray and Spaulding (2014) reported a study conducted by Stock, Siedgried and Finegan (2011) on the predictive validity of the Graduate Record Examination (GRE) scores on Economics Ph.D. The findings revealed that GRE–Quantitative (or GRE-Q) scores showed the probability of completing the programme. It therefore means that GRE-Q has more predictive power in determining success of doctoral students in Economics than GRE-verbal (or GRE-V). However, Mitchell, et al (1994) asserted that measures of verbal ability should predict, to some degree of accuracy, relevant performance criteria (as cited in Adegbile & Alabi, 2007). A study conducted by Rothstein, Paunonen, Rush and King (1994) in Sujata (2005) showed that verbal reasoning and numerical ability had significant influence on the academic achievement of students in various academic programmes.

Corengia, Pita, Mesurado and Centeno (2013) carried out a study to analyze whether educational aptitudes can predict academic performance and attrition among undergraduate students. The Differential Aptitude Test (DAT) was employed as a measure of educational aptitudes. The result showed that verbal reasoning and numerical ability were among the independent variables that related significantly to academic performance of the students in Business (Accounting and Business Economics). From their study, they noted that the reason why verbal reasoning was one of the best predictors of academic performance could be that it evaluates the basic reasoning issues of learning process. Oliver (2008) maintained that Economics students require four cognitive skills (knowledge, comprehension, application and analysis) in order to perform well in the subject (as cited in Wyk, 2012). These cognitive skills promote critical thinking and reasoning ability.

Most of the available studies (Schuhmann et al, 2005; Stock et al, 2011, as cited in Bray & Spaulding, 2011; Rothstein et al, 1994, as cited in Sujata, 2005; Corengia et al, 2013) on quantitative and verbal aptitudes (or abilities) are based on university achievement in Economics in developed countries. With regards to Nigeria, there are limited studies on the influence of quantitative ability or aptitude on performance in Economics and no study on the influence of verbal aptitude was found in the literature. Some researchers who examined verbal variable in other subjects or areas made generalizations regarding its effect on academic performance. Therefore, this study sought to address these gaps. It is expected that this study can add to the limited empirical findings and provide a springboard for future studies in Nigeria, with regards to verbal aptitude.

Purpose of the Study

The main purpose of the study was to examine the predictive power of quantitative and verbal aptitudes on the performance of senior secondary school students in Economics.

Research Questions

1. Does quantitative aptitude significantly predict the performance of senior secondary school students in Economics?
2. Does verbal aptitude significantly predict the performance of senior secondary school students in Economics?
3. Does the combined effect of quantitative and verbal aptitudes significantly predict the performance of senior secondary school students in Economics?

Methodology

The population of the study comprised senior secondary two (SS2) Economics students in Oshodi-Isolo Local Government Area of Lagos State, Nigeria. This included both public and private school students. The study adopted descriptive survey research design. Multistage sampling technique was employed in selecting a total of 330 senior secondary two Economics students from 10 schools comprising five private and five public schools. Data was gathered with three test instruments namely the Economics Achievement Test (EAT), the Quantitative Aptitude Test (QAT) and the Verbal Aptitude Test (VAT). The reliability coefficient of the instruments was established using the Pearson Product Moment correlation coefficient and was found to be 0.86 for EAT, 0.81 for QAT and 0.93 for VAT respectively. Data was analyzed using ANOVA and multiple regression of the SPSS.

Results

Table 1 shows an F-value of 72.451 and a p-value of 0.000. This finding indicates that quantitative aptitude significantly predicts the performance of senior secondary school students in Economics and this has answered research question number one.

Table 1: ANOVA of quantitative aptitude as a predictor of performance of senior secondary school students in Economics

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2790.118	1	2790.118	72.451	.000(a)
	Residual	12631.336	328	38.510		
	Total	15421.455	329			

Table 2 shows an F-value of 45.113 and a p-value of 0.000. This finding indicates that verbal aptitude also significantly predicts the performance of senior secondary school students in Economics and this has answered research question number two.

Table 2: ANOVA of verbal aptitude as a predictor of performance of senior secondary school students in Economics

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1864.601	1	1864.601	45.113	.000(a)
	Residual	13556.853	328	41.332		
	Total	15421.455	329			

Table 3 shows an F-value of 45.041 and a p-value of 0.000. This finding indicates that the combined effect of quantitative and verbal aptitudes significantly predicts the performance of senior secondary school students in Economics and this has answered research question number three. The table shows R^2 values of 0.216, indicating that 21.6% of the variance in the achievement of senior secondary school students in Economics is accounted for by the combined effect of the two variables.

Table 3: ANOVA, model summary and coefficients of the multiple regression analysis of the combined effect of quantitative and verbal aptitudes in predicting performance of senior secondary school students in Economics

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3330.734	2	1665.367	45.041	.000(a)
	Residual	12090.721	327	36.975		
	Total	15421.455	329			

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.465(a)	.216	.211	6.081

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	7.750	1.550		5.001	.000
	verbal aptitude	.239	.063	.206	3.824	.000
	quantitative aptitude	.352	.056	.339	6.297	.000

From the table, quantitative aptitude ($B = 0.339$) has more predictive power on the academic performance of senior secondary school students in Economics than verbal aptitude ($B = 0.206$).

Discussion

The result of the analysis in table one revealed that quantitative aptitude predicts the performance of senior secondary school students in Economics. This finding agrees with the findings of Adu et al, (2009); Schuhmann et al, (2005); Stock et al, 2011, as cited in Bray et al, 2014) and Corengia et al, (2013) that reported that quantitative aptitude or ability influences academic performance in Economics. As Adu et al (2009) noted from their study, no student can perform well in Economics without good quantitative ability. Similarly, Schuhmann et al (2005) maintained that higher economic knowledge is dependent on the possession of quantitative skills. Economics is taught using quantitative language and so this finding demonstrates the importance of quantitative skills in facilitating learning outcomes.

The result of the analysis in table two showed that verbal aptitude predicts the performance of senior secondary school students in Economics. This finding is in line with the findings of Rothstein et al (1994), as cited in Sujata (2005) which showed that verbal reasoning significantly influenced academic achievements in various undergraduate programmes and also those of Corengia, et al (2013) which showed that verbal ability significantly predicted performance in Business Economics. As asserted by Mitchell, et al (1994), as cited in Adegbile, et al (2007), verbal ability should have some level of predictive power on academic performance.

The result of the analysis in table three showed the significant combined effect of quantitative and verbal aptitudes in predicting the performance of senior secondary school students in Economics. This finding agrees with the findings of Rothstein, et al (1994), as cited in Sujata (2005) and Corengia, et al (2013) which revealed that verbal reasoning and numerical ability had significant influence on the academic achievement of students in various undergraduate programmes, including Business Economics. However, the finding from this study showed that quantitative aptitude has more predictive ability than verbal aptitude. The study conducted by Stock, et al (2011), as cited in Bray, et al (2014) revealed that GRE – Quantitative (GRE – Q) scores showed the probability of completing PhD Economics programme, meaning that GRE-Q has more predictive power than GRE-verbal (or GRE-V) at that level of studies. The predictive ability of verbal aptitude in the study of Stock, et al (2011), as cited in Bray, et al (2014) appears to be in contrast with the study of Corengia, et al (2012) where it was reported that verbal reasoning was among the best predictors of achievement in undergraduate Economics. It should be noted that the study carried out by Stock, et al (2011), as cited in Bray, et al (2014) focused on PhD studies in Economics where much of the contents cover quantitative and graphical topics, requiring greater quantitative skills. The same can be said of undergraduate programmes in Economics when compared with secondary school Economics. It is therefore quite surprising that verbal aptitude has a lower predictive ability in this study compared to quantitative aptitude considering that few quantitative topics are covered in Economics at the secondary school level in Nigeria. Most of the tasks in Economics at this level of education are theoretical – more of writing than calculation. More empirical findings are needed as to which variable has more predictive power at the secondary school level. Regardless of the fact that the predictive ability of verbal aptitude is not as strong as that of quantitative aptitude in this study, an improvement in verbal aptitude or skill will contribute towards the performance of students in Economics. As Adegbile, et al (2007) noted, students' grades to a large extent are associated with verbal ability. Going by the assertion of Oliver (2008) that Economics students require four cognitive skills (knowledge, comprehension, application and analysis) in order to perform

well in the subject (as cited in Wyk, 2012), achievement outcomes will improve if these cognitive skills are properly applied as they are related to verbal aptitude.

Recommendations

From the findings of the study, the recommendations are as follows:

School authorities should provide learning materials that will help improve quantitative and verbal skills of students.

Students should be encouraged to be more liberal in their learning by availing themselves of every opportunity to sharpen their reasoning, verbal and numerical (quantitative) skills. They should read widely, consult materials on these variables, and pay attention to the learning of English and Mathematics as well as other subjects.

Teachers should encourage learners to develop higher-order thinking skills by presenting questions and tasks that demand logical and critical reasoning. They should also explore all areas that will help students to sharpen their verbal and quantitative skills. Apart from having a mastery of the subject matter, it is necessary that they simplify concepts, especially mathematical and graphical topics, by utilizing different instructional methodologies and using appropriate teaching aids.

The government should ensure that adequate and well qualified teachers are employed to teach Economics, and quantitative and verbal related subjects. Some researchers have suggested the introduction of critical thinking as a subject in senior secondary schools. If this is done, it will enhance the learning of students in quantitative subjects.

Conclusion

This study was necessitated by the growing concern over the poor performance of secondary school students in Economics, especially in public examinations as reported from previous studies and the limited empirical findings on the variables investigated in Nigeria. There is scarcely any study on the verbal variable as it pertains to performance in Economics to the best of the researcher's knowledge. Findings from the study have revealed that quantitative and verbal aptitudes predict performance in Economics at the senior secondary school. Economics is a subject that utilizes mathematical, graphical and theoretical or abstract languages in examining and explaining concepts which makes the subject appear to be difficult for many students. This is why the teaching and learning of the subject should be simplified and students encouraged to develop quantitative and verbal skills. The study therefore concludes that possession of these aptitudes or skills by students will enhance their performance in the subject. Considering the effects of these variables on Economics, it is necessary for more empirical studies to be made available in Nigeria using a larger sample size.

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**In-Service Teacher Training and Professional Development of Primary School Teachers
in Uganda**

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Abstract

In 1994, Uganda's Ministry of Education and Sports introduced Teacher Development Management Systems, with the sole aim of supporting and enhancing professional development of teachers through in-service teacher training. Though the training has increasingly motivated teachers into upgrading their academic qualifications, research has not established the effect of the training on professional development of teachers and loopholes, assumptions and misconceptions still persist two decades after the inception of the Teacher Management Systems. Using primary data collected in 2016 from the southwestern Uganda districts of Bushenyi, Rukungiri and Sheema, this study attempts to examine this issue. Key informant interviews and questionnaires were used to collect data from a sample of 610 primary teachers and education stakeholders selected for the study. Findings show that in-service teacher training has a significant effect on teachers, particularly on their academic qualifications, performance, and professionalism. However, these benefits can only be realized when the training is properly planned, implemented and continually evaluated, and in the presence of certain resources and incentives. To this end, the study recommends a review of teacher training approaches and a revamp of school environments to facilitate the teaching-learning process.

Keywords: teacher, in-service teacher training, Uganda, professional development, education

Introduction

In-service teacher training is globally practiced with the belief that it fosters professional development of teachers. Specifically, the training has been adopted to promote continuous improvement of teaching staff, eliminate differences within the background preparation of teachers, keep the teaching profession abreast of new knowledge, enable realization of creative innovations, and facilitate teachers to tackle responsibilities associated with the changing learning environment (Osamwonyi, 2016; Sheth, 2004). According to Bramley (1991), in-service training is the systematic development of attitudes, knowledge, skills, and behavior patterns required by teachers to perform adequately at their given task or job.

In Uganda, education sector reforms such as in-service teacher training were reignited in 1987 to revive the education system, which had collapsed due to political turmoil. The Education Policy Review Commission (EPRC) was appointed to assess the education sector and give recommendations towards policy restoration and improvement. Key indicators of quality of education in Uganda such as cohort survival rates, pupil/teacher ratios and teacher attrition had worsened to an extent where the existent education system could not fulfill anticipated objectives (Eilor, 2003). The acknowledgement of a failed system instigated the inception of Teacher Development Management Systems (TDMS) in 1994 to reinforce the teaching workforce. TDMS was implemented with a single main objective of improving quality and equity in provision of primary education through improved school management and quality of instruction (teaching). Through implementation of a number of in-service strategies and activities, TDMS sought to equip head teachers and teachers with the necessary skills, with an ultimate goal of fostering effectiveness (Ministry of Education and Sports, 2010). This work presents an analysis of the effect of in-service teacher training on professional development, including attitudes, practices and professional grounding of primary teachers in Uganda.

Literature Review

Emphasis is placed on the role of education and teacher training agency towards national, social and economic development. This calls for continuous development and improvement of professional competence of education stakeholders. In-service teacher training is pursued with the primary goal of ensuring continued improvement in the capacity of academic institutions and the entire education system (European Union, 2013). In-service teacher training is thus defined as a central component of professional development of teachers that has been adopted by policy makers and education departments to orient teachers and equip them with skills aimed at enhancing the quality of education. On the other hand, professional development is a recurring process instigated by changes in knowledge, beliefs, and attitudes among teachers and other education service sector workers towards improving learning outcomes (Cooper, 2004; Sparks & Richardson, 1998).

Rapid technology advancements in the contemporary world imply that teachers' stock of knowledge and pedagogical skills becomes obsolete in a short time. This calls for constant upgrading to keep up with modern trends and knowledge (Wesch, 2009). Yet, new experiences demand new and specifically tailored approaches with regard to teaching methods, which justifies the need for teachers to be exposed to in-service training programs from time to time. This depicts in-service teacher training as a continuous, never ending process focused on acquiring and maintaining knowledge. Simply put, the training

continually equips teachers with new pedagogical skills towards a country's bid to shift the education system towards an outcome-based one (Okiror, Hayward, & Winterbottom, 2017).

Traditional professional development approaches fail to foster changes necessary for inclusive learning (Nishimura, 2014), which calls for in-service techniques that prepare teachers to adopt varied teaching methods, use improved technology and integrate new knowledge, and experiences into classroom practices (Sabri, 1997). Evidence suggests that these enable in-service teachers to teach in inclusive classrooms with relative ease (Sokal & Sharma, 2014). Some of these acclaimed techniques include observation by facilitators, teacher collaboration and co-teaching, and participatory action research (Morales, 2016; Villa, Thousand, & Nevin, 2013). Online techniques have also been pursued (Cavanagh, 2013), but the level of success depends on whether the teachers are familiar with technology, self-motivated, and disciplined (P. Vu, Cao, L. Vu, & Cepero, 2014). In alternative evidence, the introduction of technological advancement does not necessarily guarantee application in teaching practice (Sabzian & Gilakjani, 2013). Nevertheless, all arguments for in-service teacher training and technological and knowledge advancement fall to a few problematic assumptions. First, by ignoring the final consumer of knowledge, the learner, these studies assume that learners will automatically adjust to the ever-changing techniques and easily absorb new knowledge offered by trained teachers. Second, they seem to suggest teachers' learning processes as linear paths towards an ever-shifting optimum knowledge. Third, without a definitive measure of knowledge attributable to technology advancements, evaluation of the training becomes a gamble of assumptions.

In practice, in-service teacher training is recognized as an essential part of the overall process of teacher education, which can be achieved through attending events such as lectures, films, exhibitions, conferences, seminars, and workshops in which practical solutions to current difficulties are introduced and materials required for implementing these solutions produced (Alkuş & Olgan, 2014; Osamwonyi, 2016). These events also provide platforms through which teachers are introduced to new developments and teaching materials to help them in their work, such as new curricular, new methods and innovations, and specific equipment. But the question remains of how these programs are implemented with regard to method and approach and if there is a methodology in place to facilitate the transfer of acquired knowledge from teacher to learner. In a study of in-service teacher training in Nigeria, Amadi (2013) notes that although in-service training has been embraced to counter the inadequacies of pre-service training, it still fails to adequately prepare teachers for the continued changes in teaching techniques and materials. The study attributes continued poor performance of schools to teacher training programs, which are conducted using approaches that are not practical and as a result coerce teachers into "just listening" but not putting into practice the novel teaching methods learned. In-service teacher training in most developing countries, Uganda included, fall victim to such shortcomings whereby teachers are not equipped with transferable and hands-on pedagogical skills. The developing world "train the teacher, train the nation" mentality has culminated in negligence and rigid governments who have washed their hands of all responsibility, beyond the teacher, to facilitate the teaching-learning process. Yet, scholarship on in-service teacher training has found that effectiveness of the training can only be achieved with proper planning and implementation (Zaslow, 2014). This involves among others: pre-training analysis; trainer introduction; orientation of trainees on expectations and benefits of the program; laying emphasis on the need to master content knowledge and garner authentic experiences; and creating and maintaining a stable feedback process between training and application of experiences through reflection and evaluation (Dunst, Bruder, & Hamby, 2015; Ficarra & Quinn, 2014).

Generally, in-service teacher training should motivate teacher professionalism in self-evaluation of strengths and weaknesses, and knowledge and pedagogical skills. In-service teacher training is therefore a capacity building task that stimulates organizational growth and development (Omar, 2014). The training engenders change in human behavior, attitudes, knowledge, skills, and capabilities focused on cultivating professional etiquette required by teachers to perform adequately at given tasks (Guskey, 2014; Kabadayi, 2016). Some studies have, however, found little effect of in-service teacher training on benefits such as content knowledge and skills, and observed a lack of systematic evaluation processes (B. Boyle, While, & T. Boyle, 2004; Lehist, 2015; Newton, 2013). All these studies point to a difficulty in measuring the impact of in-service teacher training on professional development in definite terms, which poses a challenge for evaluation. To counter this, qualitative approaches have been pursued where, for instance, a change in knowledge may be characterized by having a firm grasp on job requirements and increased ability to make the right decisions in selecting the most appropriate procedure in accomplishing given tasks while a change in skills encompasses ability to communicate, and increased capacity to perform simple procedures and physically grounded actions. However, we note that studies do not agree on definitions of the different factors of professional development. For instance, while Kabadayi (2016) defines it to include teacher roles, and professional and practical knowledge, Dunst et al. (2015) include both teacher and learner experiences. From these studies, we observe contradictions not just on definition but also categorization of variables. For instance, knowledge has been categorized along pedagogical, practical, and content knowledge among others for some studies while others just leave it general. These challenges leave a lot of room for ambiguity and assumption and facilitate a broad and unstable spectrum along which professional development must be measured.

Another challenge for in-service teacher training is that the role of trainers is not clearly defined which implies that training requirements are not properly addressed (Council of the European Union, 2009; O'Dwyer & Athi, 2015). For in-service training to be effective, "backward planning" must be emphasized to ensure that in-service training exactly matches teacher and learner needs and addresses the intended objectives (Bayar, 2014; Guskey, 2014). To truly appreciate the impact of in-service training on professional development, learners must be brought to center stage of evaluation processes (Earley & Porritt, 2014). The intention of in-service teacher training has always been to enhance professional and personal development of teachers to provide its benefits to the students they teach, their classes and schools where they serve (Mahmood, 1999). The ultimate goal here is to improve the teaching-learning process and establish systems that absorb various changes that concern education. According to Zaman (2004), teacher development is fundamental to the quality of the education system and as such demands urgent, careful and continued attention to improve and maintain the quality. The consequent staff development boosts instruction capacity and teacher competence by increasing their command of their academic subject (Borg, 2018; Glickman, 1990; Ololube, 2005). Teacher competence encompasses not just teacher knowledge and skills but also their motivation, attitudes, and social behavior (Zlatić, Bjekić, Marinković, & Bojović, 2014). This variable thus also falls victim to the same problem of immeasurability. To appreciate the impact of in-service training, different studies have had to devise different metrics to measure variables. Yet, these variables rarely conform to such linear binaries.

In more quantifiable terms, in-service teacher training programs significantly advance teachers careers and aid unqualified teachers in their upgrading to qualified teacher status (Hersey & Blanchard, 1988; Junaid & Maka, 2015; Morrison, 1993; National Staff

Development Council, 2007). Upgrading teachers' education enables them to rectify the faults, superficiality, duplication, and irrelevance of life in schools in relation to real society (Mbiti, 1990). According to his findings, training programs must engage in the search for the underlying factors associated with complex issues in present society to enable development of a realistic system. Some of these factors may take the form of curriculum, school infrastructure, scholastic materials and funding among others. We hypothesize that if these factors were unified across academic institutions, it would enable transferability of teacher skills as well as development of an inclusive in-service teacher training program across training institutions. Yet, that is not always the case due to resource constraints and varied accessibility options available to different institutions and schools.

Generally, in-service teacher training gives teachers adequate groundwork on the needs of learners and provides them with a well-integrated general education, professional training and academic orientation (Kabadayi, 2016; Ololube, 2005). At its core, it aids teachers in obtaining a good grasp of the curriculum (Viirpalu & Mikser, 2014). In their study on performance of science teachers in secondary schools, Shakoor, Ghumman, and Mahmood (2013) found that by raising awareness of curricular changes to teachers, in-service teacher training led to better planning of content and delivery and improved the effectiveness of implementation of curricula. By increasing confidence and motivation of teachers, in-service teacher training improves their career prospects as well as their professional identity (Ju Youn, 2011). This concurs with findings by Yadav and Bhardwaj (2013) that confidence instilled by in-service teacher training program facilitates planning and preparation towards effective teaching. These skills lead to the building of a human resource pool that is dedicated and committed to teaching and positively influencing the overall delivery in the education system.

Data and Methods

In this analysis, we use primary data collected from a sample of 610 primary school teachers in the districts of Bushenyi, Rukungiri and Sheema. The study met the moral and ethical standards of research by observing maximum confidentiality of the respondents' identities. Anonymity was maintained by coding the questionnaires instead of putting individuals' names. Subject participation in the study was voluntary and verbal consent was sought from participants prior to involvement in the study. Participants were informed about what it meant to be involved in the study, what was expected of them, the objectives of the study and their right to decline participation.

The study applied a descriptive research design to obtain the required data. Questionnaires and key informant interviews were used in data collection. The research instruments were pilot tested to ensure their validity. Triangulation of the two methods with secondary sources also addressed validity concerns by enabling double-checking and countering inconsistencies in the tools.

Data analysis was done in three parts. First, a descriptive analysis was done to compare the characteristics of teachers across selected demographic and socioeconomic backgrounds including district, sex, qualification, number of years in service and age. Second, predictors of in-service teacher training were established using the binary logistic regression. Third, teachers' perception of the effect of in-service teacher training on professional development were investigated using a Likert scale of 11 criteria namely:

1. It enables teachers to acquire new skills and knowledge
2. It enables teachers to provide quality education to learners
3. It enables teachers to upgrade their academic qualification
4. It enables teachers to acquire promotion
5. It enables teachers to play a key role in the proper implementation of various education policies and programs
6. It broadens and deepens teachers' own knowledge, increases on their competence, reliability, and responsibility
7. In-service trained teachers become more professional by mastering the content
8. In-service trained teachers become more professional by getting motivated on the job
9. In-service trained teachers have a good command of their academic subjects and ably meet the needs of learners
10. Teachers who have had in-service teacher training are good performers in school
11. In-service trained head teachers are better administrators than those taught through other programs

'1' represents the lowest rank (strongly disagree) and '4' the highest rank (strongly agree). First, the Cronbach's alpha test was used to measure reliability and internal consistency of the scale. Results show an alpha of 0.773, which indicated that the scale had a good reliability and consistently measured the effect of in-service teacher training on professional development. The test further showed that removal of any variable reduces the Cronbach's alpha, which was an indicator that there was no redundancy and the variables were well defined. The median was then used to infer on each of the criteria. Further, the Mann-Whitney U test was used to understand whether the status of in-service teacher training of respondent had any significant effect on ranking of the different criteria at 5% level of significance. The Mann-Whitney U test was selected as the most appropriate test given that the data was ordinal and did not assume a normal distribution.

In conducting the study, the researchers encountered certain limitations including: lack of co-operation from some respondents who refused to answer the questions, some respondents asked to be paid to participate so their perceptions are missing here, and difficulty in recruiting experienced research assistants which increased the training and supervision costs.

Results and Discussion

Table 1 presents the distribution of respondents by background characteristics. Bushenyi district had the highest number of respondents with 36.1% while Sheema district had the least with 30.2%. Males constituted the largest proportion of respondents with 68.4% while females constituted only 31.6%. The results also show that majority of the respondents were Diploma holders (72.3%) followed by 16.4% Grade III holders and 11% graduates leaving only 0.3% with postgraduate qualifications. Results further show that majority of the respondents (84.4%) had ever attended in-service training leaving only 15.6% who had not. Finally, most of the respondents (27.5%) had 11-15 years of service followed by 21.8% with 16-20 years of service and only 12.5% with 1-5 years.

Table 1: Distribution of background characteristics of respondents

Characteristic	Frequency (n)	Percent (%)
District		
Bushenyi	220	36.1

Characteristic	Frequency (n)	Percent (%)
Rukungiri	184	30.2
Sheema	206	33.8
Sex		
Male	417	68.4
Female	193	31.6
Qualification		
Grade III	100	16.4
Diploma	441	72.3
Bachelor	67	11.0
PhD	2	0.3
In-service teacher training		
Yes	515	84.4
No	95	15.6
Number of years in service		
1-5 yrs.	76	12.5
6-10 yrs.	112	18.4
11-15 yrs	168	27.5
16-20 yrs.	133	21.8
20+ yrs.	121	19.8
Total	610	100.0

Table 2 presents the descriptive statistics for selected indicator variables. The findings show that there are significant differences in status of in-service training by number of years of service. The category of persons with 16-20 years of service had the largest proportion of teachers with in-service training (93.98%) followed by those with 20+ years of service with 85.95%. With regard to the category of qualification, diploma holders had the highest proportion of teachers with in-service training (87.53%) while postgraduate holders had none. The relationship between in-service teacher training and district was also examined, but there was no significant difference at 5% though the relationship was significant at 10%. The effect of sex on in-service teacher training was also found not to be significant.

Table 2: Descriptive statistics for selected indicator variables (N=2,364)

Variable/category	In-service teacher training status of teacher (%)			
	Yes	No	χ^2	p-value
District				
Bushenyi	81.82	18.18	5.671	0.059
Rukungiri	82.07	17.93		
Sheema	89.32	10.68		
Sex				
Male	85.37	14.63	0.896	0.344
Female	82.38	17.62		
Years of Service				
1-5yrs	73.68	26.32	17.236	0.002
6-10yrs	82.14	17.86		
11-15yrs	82.14	17.86		
16-20yrs	93.98	6.02		
20+yrs	85.95	14.05		
Qualification				
Grade III	74.00	26.00	22.616	0.000
Diploma	87.53	12.47		
Bachelors	82.09	17.91		
Postgraduate	0.00	100.00		

Table 3 shows the odds of a teacher having in-service training as opposed to not having the training. The findings show that the odds of a teacher with a diploma or a bachelors or post graduate degree having in-service teacher training were significantly higher than those of a Grade III teacher with respective p-values less than 0.05. Findings also show that teachers with 6-10 years of service were significantly less likely to have in-service teacher training than teachers with 1-5 years of service (OR=0.247, $p<0.05$). The other categories showed no significant difference from teachers in the 1-5yrs category. Results further show that a unit increase in age is associated with a 4.6% reduction in the odds of a teacher having in-service teacher training ($p<0.05$) meaning that younger people had a higher likelihood of having in-service training. Finally, results show that teachers in Rukungiri were significantly less likely to have in-service teacher training than teachers in Bushenyi with (OR=0.528, $p<0.05$).

Table 3: Binary logistic regression predicting the odds of a teacher's in-service training outcomes (base category=no in-service training)

Variable	OR	S.E.	p-value
Sex			
Male†	1.000		
Female	1.465	0.260	0.142
Qualification			
Grade III†	1.000		
Diploma	32.727	1.114	0.002
Bachelors	75.555	1.126	0.000
Post Graduate	50.039	1.132	0.001
Age	0.954	0.024	0.046
Years of Service			
1-5yrs†	1.000		
6-10yrs	0.247	0.538	0.009
11-15yrs	0.504	0.475	0.150
16-20yrs	0.559	0.385	0.131
20+yrs	2.041	0.462	0.123
District			
Bushenyi†	1.000		
Rukungiri	0.528	0.295	0.030
Sheema	0.610	0.312	0.114

OR= Odds Ratio; S.E. = standard error; †= Reference Category

Perception of the Effect of In-Service Teacher Training on Professional Development

The results in Table 4 show that upgrading teachers' academic qualifications was the most considered criterion of effect of in-service teacher training with 70.89% of respondents expressing strong agreement that in-service teacher training enables teachers to upgrade their academic qualifications, followed by enabling teachers to acquire promotion (69.64%), enabling teachers acquire new skills and knowledge (63.17%), and broadening and deepening teachers' knowledge which increases their competence, reliability, and responsibility (46.50%). The other criteria, though considered strongly agreeable by less than 50% of respondents, were still considered agreeable with respective medians of 3. Specifically, results show that 56.57% of respondents expressed agreement that in-service teacher training enables teachers to become more professional by motivating them on the job followed by, in descending order: enabling teachers to have a good command of their academic subjects and ably meet the needs of learners (56.35%), enabling teachers to provide quality education to learners (55.37%), enabling teachers to become professional by mastering the content (53.13%), enabling teachers to play a key role in the proper implementation of various

education policies and programs (51.99%), improving the performance of teachers (49.5%) and enabling head teachers to become better administrators with 41.78%.

The finding that in-service teacher training had its largest influence on upgrading teachers' academic qualifications concurs with Mbiti (1990) who underlined the role played by in-service teacher training in upgrading teachers' education which in turn enables teachers rectify the faults, superficiality, duplication and irrelevance of classroom settings in relation to real life society. Further, findings show that in-service teacher training enables teachers to pursue promotion opportunities in support to Morrison's (1993) findings that teachers train to upgrade and qualify for higher positions. The findings that in-service teacher training motivates teachers on their job, and instigates a change in teachers' behavior, attitudes, and capabilities all focused on cultivating professional etiquette required to perform adequately resonate with conclusions arrived at by Hersey and Blanchard (1988), Ololube (2005) and Junaid and Maka (2015).

Table 4: Perception of effect of in-service teacher training on professional development

Effect of in-service training on professional development of teachers	Strongly disagree	Disagree	Agree	Strongly agree	Median
i. It enables teachers acquire new skills and knowledge	0.67	2.00	34.17	63.17	4
ii. It enables teachers provide quality education to learners	2.68	6.54	55.37	35.40	3
iii. It enables teachers upgrade their academic qualification	0.66	3.29	25.16	70.89	4
iv. It enables teachers to acquire promotion	0.99	4.95	24.42	69.64	4
v. It enables teachers to play a key role in the proper implementation of various education policies and programs	1.49	9.93	51.99	36.59	3
vi. It broadens and deepens teachers' own knowledge, increases on their competence, reliability and responsibility	1.83	6.67	45.00	46.50	3
vii. In-service trained teachers become more professional by mastering the content	5.26	13.32	53.13	28.29	3
viii. In-service trained teachers become more professional by getting motivated on the job	7.48	20.44	56.57	15.51	3
ix. In-service trained teachers have a good command of their academic subjects and ably meet the needs of learners	1.84	13.04	56.35	28.76	3
x. Teachers who have had in-service teacher training are good performers in school	6.11	21.12	49.50	23.27	3
xi. In-service trained head teachers are better administrators than those taught through other programs	7.72	23.83	41.78	26.68	3

Findings from the interviews show that in-service trained teachers are better teachers as far as provision of education is concerned. A head teacher was quick to note that they are better and more sociable (Field Interview No. 2) while another said that in-service trained teachers are serious at their work, especially if they are in positions of responsibility (Field Interview No. 3). *“Those who are serious at work provide quality education and are good administrators,”* observed one district education officer (Field Interview No. 9). Another education officer noted that when in-service trained teachers are promoted in administrative positions, they are motivated to even improve their teaching abilities and to provide a good example for other teachers as well as learners (Field Interview No. 7). This in turn increases their level of professionalism (Field Interview No. 5). Professionalism is also measured in terms of qualification for promotion. One inspector of schools asserted that in-service teacher training provides opportunity for teachers to further their education, which is key in acquiring promotion (Field Interview No. 6). Another school leader noted that in fact, the ability of a teacher to use different teaching techniques gives them a competitive edge when applying for promotion (Field Interview No. 2). An education officer confirmed this saying that *“when looking for teachers to hold positions of responsibility, those with better qualifications take first priority”* (Field Interview No. 9).

With regard to teaching technique, one inspector of schools observed that in-service trained teachers teach better because they teach their subjects of specialization (Field Interview No. 6). Since teachers individually select these subjects during the in-service teacher training, it shows that they take joy in both learning and teaching them, which facilitates a better teaching-learning environment (Field Interview No. 8). One school head, however, asserted that in-service trained teachers only become better teachers if they strictly apply the gained knowledge and skills (Field Interview No. 1). With regard to learners' experiences, a head teacher observed that in his school, pupils had better relationships with in-service trained teachers and were more sociable during their classes (Field Interview No. 10). *“They (in-service trained teachers) encourage pupils to build teams and you find that their pupils easily make groups to enable their academic work,”* said another head teacher of the pupils in classes taught by in-service trained teachers (Field Interview No. 12).

A head teacher in Sheema and another in Bushenyi noted that in-service trained teachers who are talented at co-curricular activities are always eager to assist pupils in various games (Field Interview No. 11 and Field Interview No. 13). In-service trained teachers also give their pupils free time to socialize and make groups that help them play different games depending on the likes of the group (Field Interview No. 18). Some head teachers in Sheema and Rukungiri reported that in-service trained teachers not only help with games but also with other skills such as music and scouting (Field Interview No. 16), handiwork like making carpets, baskets, and table cloths (Field Interview No. 2) and other outside class activities like gardening and compound cleaning (Field Interview No. 17).

Though the effect of in-service teacher training on professional development is colored with approval, our study also found, through key informant interviews, that not all in-service trained teachers provide good education and their professional development is suspect as discussed in the subsequent section.

Most head teachers expressed disappointment in the professional discipline of in-service trained teachers noting their inability to yield to leadership. One head teacher noted that when teachers upgrade to the same level of qualification, they become undisciplined (Field Interview No. 1). This train of thought was further supported by two officials in Rukungiri

who both observed lack of discipline cases among in-service trained teachers, mostly in cases where the teachers became more or equally as qualified as their head teachers (Field Interview No. 5 and Field Interview No. 8). Some such cases, as observed by one head teacher, involve in-service trained teachers refusing to teach infant classes which they initially taught before the training (Field Interview No. 2). This was attributed to the introduction of thematic curriculum, which emphasizes teaching infants in vernacular. *“However, in-service trained teachers often show resentment towards this method with a preference to use the English language in teaching,”* he added. Another head teacher contributed to the arguments saying that in some instances, an unhealthy competition and in others disrespect for authority have been instigated between teachers and their supervisors (Field Interview No. 6).

Another school head teacher observed that most teachers would, after the training, demand immediate promotion (Field Interview No. 4) and salary increment and when not granted, they *“simply become stubborn and indisciplined”* (Field Interview No. 3). An official in one education department said that after getting better qualifications, teachers feel that they should be promoted on the job even when vacant positions are not available at the moment (Field Interview No. 7). One head teacher expressed similar sentiments saying that in-service trained teachers develop a superiority complex and often overlook other teachers especially those without training (Field Interview No. 2). This resentment was often aggravated when trained and untrained teachers still earn the same salary. A district official expressed that after in-service teacher training, most teachers start a pursuit of transition from classroom work to school administration (Field Interview No. 18). Accordingly, this stifles the fulfillment of professional ethics such as preparation of schemes of work and lesson plans, which renders in-service trained teachers inefficient. Another officer in Bushenyi seemed to agree saying that in-service trained teachers, after graduation, tend to abandon actual teaching in preference for administrative positions (Field Interview No. 16).

Some key informants expressed disappointment in the education system stating that it seems in-service teacher training is not a priority for the education ministry and teachers have to take individual initiatives to pursue the course. One official pointed out that teachers were not given time off to participate in the training and often found themselves in a fix whereby they had to teach and study all at the same time (Field Interview No. 14). He explained that the two programs were done concurrently which left teachers no time to complete the syllabus. One head teacher added that in-service trained teachers at times used classroom time to attend to their studies, hold discussions, answer assignments and so on, leaving them little time to stick to actual teaching (Field Interview No. 15). Another head teacher pointed out that when he was attending the training some years prior to the study, he always found himself stuck with duties to perform such as preparing schemes of work, eight lesson plans per day and general school administration in addition to the training (Field Interview No. 10). According to him, the pressure to perform both responsibilities was overpowering, he always found himself underperforming at one of them.

Some respondents questioned the ministry of education on the way in-service training is organized. One official noted that teachers are, during the training, exposed to many innovations. However, when they go back to their schools, they do not practice what they have been taught because it does not blend into the stipulated school syllabus. This interface in the application of acquired knowledge stifles the morale of trained teachers who cannot realize the impact of their training (Field Interview No. 17). A head teacher in the same district contributed to the discussion saying that the ministry imposes many changes in the

syllabus which teachers must implement yet they are not sensitized on proper application procedures (Field Interview No. 11). Another official in the education department added that in-service teacher training is designed on a syllabus that is not consistent with the one available in schools, yet nothing has been done to enhance coherence (Field Interview No. 13). Further, schools are not equipped with sufficient resources in the form of scholastic materials, incentives and a favorable learning environment to accommodate in-service graduates' skills.

These sentiments all point to a weakness within Uganda's education system in failing to harmonize its policies to benefit both teachers and learners. As such, the majority of teachers have pursued in-service teacher training not to improve their teaching abilities and learners' attainment of education but rather for promotion purposes and to qualify for salary increment.

Inferential Analysis

The Mann-Whitney U test was used to discover the impact of respondent's status of in-service training on their perception of effect of in-service teacher training on professional development. We tested the null that in-service teacher training status of respondent had no significant effect on ranking of criteria for effect of in-service teacher training on professional development.

Table 4: Perception of effect of in-service teacher training on professional development by respondent's status of training

	In-service teacher training enables teachers acquire new skills and knowledge	In-service teacher training enables teachers upgrade their academic qualification
Mann-Whitney U	20501	21231
Wilcoxon W	24687	25791
Z	-2.074	-2.517
p-value	0.038	0.012

Findings show that teachers without in-service teacher training ranked "In-service teacher training enables teachers to acquire new skills and knowledge" and "In-service teacher training enables teachers to upgrade their academic qualification" less favorably than in-service trained teachers with p-values less than 0.05. Other criteria did not show significant difference.

Conclusion

The relevance of in-service teacher training on professional development of teachers cannot be overemphasized. Our study shows that in-service teacher training has its largest influence on upgrading teachers' academic qualifications and improving their attitude towards their job. In-service teacher training also plays a big role in equipping, broadening and deepening teachers' knowledge and skills, which in turn fosters an increase in teachers' competence, reliability, and responsibility. Further, the training equips head teachers and teachers alike with the administrative skills necessary to enable proper implementation of various education policies and programs. Generally, in-service trained teachers are more professionally grounded than untrained teachers thus in-service teacher training aids the building of a

qualified teaching workforce, whose effect on the teaching-learning environment instigates a reform in the education system.

Whereas in-service teacher training has been hailed for stimulating professional development, our study finds that not all in-service trained teachers provide good education. This is due to resource constraints such as insufficient instructional materials and teachers' accommodation and personal behavior challenges such as stubbornness, disobedience to leadership and alcoholism among others. Beyond in-service training, a teacher's performance is a reflection, to a larger extent, of the context within which he or she is working. To this end, the study recommends that learning environments within education institutions be made more conducive for the teaching-learning process.

Our findings further provide evidence that in-service teacher training has actually not realized its core objective on the ultimate beneficiary, the learner and has rather been pursued only as a means towards promotion and consequent salary increment. With this in mind, we recommend proper sensitization of teachers on the importance of the training and its effect on learners' attainment of education. The training approach must also be reviewed and revised to include a pre-training needs analysis, and training and post-training evaluation to assess the impact of the training in teaching-learning processes.

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**The Effects of Student Success Workshops on Undergraduate Hispanic STEM Students
on the U.S.-Mexico Border**

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Abstract

The goal of the College of Arts & Sciences Community-aid (CASC-aid) project, a National Science Foundation grant funded study (2016-2021), is to develop, implement, and evaluate a program that fosters a community of academic success for Hispanic STEM students. This Hispanic Serving Institute continues to provide a variety of supports to safeguard success for Hispanic CASC-aid scholars through effective communication. Along with scholarships, Project CASC-aid delivers mentoring and intervention strategies related to non-cognitive behavioral practices to ensure scholars are motivated and empowered, and to support the postsecondary educational success of Hispanic students (Blackwell, Trzesniewski, & Dweck, 2007). Embedded within the research is a Formative Experiment (Reinking & Bradley, 2008), which allowed researchers to gather data on one facet of the project. CASC-aid scholars responded to surveys after Student Success Workshops held across the 2017-2019 academic years. Analysis of results demonstrated that workshops were effective in supporting students' long-term goals, career major decisions, and overall knowledge of a wider STEM field.

Keywords: Hispanic, undergraduate, STEM, supports, workshops

Introduction

Hispanic students are often disproportionately underprepared, underrepresented, and underserved in science, technology, engineering, and mathematical (STEM) fields. Data from a variety of sources indicate that Hispanic students are often far below their white counterparts in reading and STEM areas on national and international assessments (DeSilver, 2017; NAEP, 2017). Likewise, a report in *New Scientist*, citing the United States Department of Education, revealed that: “Hispanics occupy only 2% of the STEM workforce in the United States. Additionally, only 10% of college and university degrees awarded in the STEM field are given to Hispanics” (2016, para. 4). The goal of the College of Arts & Sciences Community-aid (CASC-aid) project, a National Science Foundation (NSF) grant funded study, is to develop, implement, and evaluate a program that fosters a community of academic success for Hispanic students majoring in a STEM field. Students selected for inclusion as CASC-aid scholars receive academic and student mentoring services during mathematics courses. The purpose of this project is to support Hispanic students with a variety of interventions to ensure they can successfully navigate towards an undergraduate degree in a STEM field.

Project CASC-aid provides scholars by: (a) enhancing the first courses in the mathematics sequence, to include college algebra and calculus 1-3; (b) incorporating Learning Support in coursework, which is an alternative to traditional recitation in that learners engage in real-world applications and anticipate common misconceptions; (c) offering professor-led Community Tutoring for scholars; (d) providing Success Workshops that cultivate mentoring and yield research and service learning opportunities; and, (e) providing extensive educational experiences, events, and resources (e.g., career guidance, advising, and field trips) to all participants. In this manuscript, researchers will describe the findings of one of the support mechanisms put into place to enhance CASC-aid students’ awareness of career trajectories available post-graduation. Success Workshops allow for communication and connections between CASC-aid student scholars, faculty, and invited speakers across a range of topics directly related to career paths.

The project team designed these provisions to support and foster a community of Hispanic STEM students as they enter and exit college, completing an undergraduate degree in a STEM field. Many CASC-aid scholars are first generation college students, thus it is vital to ensure they receive effective communication about support opportunities available to them. Project CASC-aid scholars all receive sustained attention beyond that provided by the university, and key in this is the inclusion of communication at all levels to build a community of practice for scholars (Lave & Wenger, 1991; Tinto & Goodsell-Love, 1998).

The first author and co-principal investigator (co-PI) developed a survey instrument to assess the effectiveness of Success Workshops in supporting students in the CASC-aid program. The second author and Principal Investigator (PI) invited guest speakers/scholars working in STEM fields to make presentations in a series of lectures across three semesters between the 2017-2019 academic years. The project team collected data on students’ perceptions of these workshops after multiple presentations. Likewise, the PI developed Success Workshops to include presenters who are intellectuals in their respective fields. Results from data analysis revealed that the workshops had a positive impact on CASC-aid scholars’ major, job knowledge, job prospects, and career fields. Likewise, respondents demonstrated a high degree of belief in the workshops and Project CASC-aid in supporting their needs as STEM students.

Area of Concern

The percentage of Hispanic students graduating with college degrees from undergraduate programs is lower than their white counterparts for a variety of reasons (Baylor, 2016; Kao & Thompson, 2003; Viadero & Johnston, 2000), but when considering minority students' attainment of a STEM undergraduate degree, there is cause for concern (Carpi, Ronan, Falconer, & Lents, 2017; ed.gov, 2012; Leonard, 2016). In a report on Hispanics and STEM education, it was determined that "Hispanic students are more likely to be taught science by teachers who did not major in that field or by inexperienced teachers" (Crisp & Nora, 2012, p. 5). Based on empirical data, Hispanic students along the South Texas border region are disproportionately underprepared, underrepresented, and underserved in STEM fields. This under-preparation begins early in students' educational endeavors in K-12 settings. Recent data from NAEP (2017) indicated that from "1992 through 2017, the average reading score for White 8th-graders was higher than the scores of their Black and Hispanic peers" (p.7) The Committee on STEM Education noted that on international mathematics and science assessments, "Hispanic U.S. eighth graders had scores equivalent to those of students in countries ranked in the bottom third of the 45 countries that participated in the 8th grade science assessment" (2013, p.2), while white U.S. eighth graders ranked fourth behind Singapore, Chinese Taipei, and Korea.

Hispanic students entering college are already behind their white, college bound peers. As noted previously, Hispanic students lag behind their eighth-grade peers across the globe on international science assessments (Committee on STEM Education). Furthermore, on the 2015 Program for International Student Assessment, in science and reading, U.S. 15-year-olds ranked 24th, and in math, U.S. 15-year-olds ranked 39th (DeSilver, 2017). Thus, it is essential to ensure that positive outcomes at the college level are possible for minorities and females, two underrepresented groups in STEM careers; and these outcomes include undergraduate graduation from a STEM field. In addition to under-preparation, Baylor (2016) noted 21% of black students and 16% of Hispanic students have an undergraduate degree, while 43% of their white peers have graduate from college. Likewise, some universities have closed door policies for minorities (Baylor, 2016). These factors all pose additional barriers for Hispanic students seeking a STEM degree.

Along with under-preparation in K-12 schooling, acquiring an undergraduate degree, and potential difficulty getting into college, there are other general roadblocks to STEM retention and completion for Hispanic students in undergraduate bachelor's programs. One roadblock includes mathematics. Researchers have demonstrated that mathematics attainment is a cornerstone to college access, degree completion, and specifically to successful STEM pursuit (Kredell, 2017; uschamberfoundation.org). Likewise, a strong academic math program through completion of higher-level math in high school is important to success in college (Adelman, 2006). McCormick and Lucas (2011) noted that mathematics preparation at the high school level plays a prominent role in students' "hopes and dreams for a college degree" (p. 1). However, researchers are unsure of the added benefit pre-Calculus and other developmental math courses at the college level have on students' later success in college-level Calculus (Bressoud, 2016). Additionally, girls' self-efficacy in math is a strong predictor of declaring a STEM major (Brookshire, 2017).

In addition, an important barrier to enhanced college graduation rates from underrepresented students in STEM fields is a lack of college knowledge (Brooks-Terry, 1988; Horn & Nuñez, 2000; Ishanti & DesJardins, 2002; Ishanti, 2006; Moschetti & Hudley, 2014). There is a high correlation between low socioeconomic status and college graduation, and this has led

researchers to extend beyond content knowledge in search of obstacles to college graduation (Estep, 2016; Rheinschmidt & Mendoza-Denton, 2014). One common area identified was the misunderstanding of college readiness. Conley (2007) defines college readiness as consisting of four concentric ideas: (a) key cognitive strategies, (b) key content, (c) academic behaviors, and (d) contextual skills and awareness. This underscores the idea that students need more than content knowledge to be successful in college. Research conducted through the American College Testing (ACT) agency revealed that underserved students, that is, first generation college students, often fail to achieve benchmarks, and this can lead to “progressively lower college and career readiness rates” (2018, p. 9). In addition, there is an affective component related to a student’s STEM college identity and high-achieving high school STEM students do not identify with: (a) feelings of low self-confidence and/or self-efficacy, (b) a lack time management and test taking skills, or, (c) ideas of low motivation and determination (Huguenin, 2014). This is often not the case for their underprepared minority counterparts.

Hispanic students may lack college knowledge, but they may also lack an understanding of job opportunities that align with specific STEM degrees. The Student Success workshops provided through Project CASC-aid may support student understanding and learning, as well as fill a knowledge gap for scholars.

Potential Solution: Supports for CASC-aid Scholars

In our ever-changing technological society, there is a growing need for a substantive call to increasing the number of Hispanic and other minority students graduating from undergraduate STEM programs. Multiple studies have determined that undergraduate research opportunities can support and increase retention of minority students in STEM majors (Carpi & Lents, 2013; Junge, Quinones, Kakietek, Teodorescu, & Marsteller, 2010; Kardash, 2000; Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998). However, not all colleges and universities offer research opportunities at the undergraduate level. Thus, it is imperative to provide interventions that ensure Hispanic and other minority students are successful in completing undergraduate degrees, particularly STEM degrees.

Notably, a Report from the Committee on STEM Education National Science and Technology Council (2013), and the follow-up progress report from the Office of Science and Technology Policy (OSTP, 2016), highlighted the following need: “Increase the number of underrepresented groups that graduate with STEM degrees in the next 10 years and improve women’s participation in areas of STEM where they are significantly underrepresented” (2016, p. 12). As new technologies advance daily, it is important to support Hispanic STEM students in graduating with an undergraduate STEM degree, particularly female students.

Additionally, the House of Representatives (H.R.) Bill 2653: STEM Opportunities Act (2017) noted that “In 2015, underrepresented minority groups comprised 39 percent of the college-age population of the United States, but only 17 percent of students earning bachelor’s degrees in STEM fields” (p. 3, lines 1-4). The STEM Opportunities Act (II.c.1) aims to increase “implementation or expansion of innovative, research-based approaches to broaden participation of underrepresented minority groups in STEM fields” (p. 32, lines 6-9). Project CASC-aid is an innovative, NSF grant funded study that aims to increase underrepresented students into STEM fields. The Student Success Workshops are just one support provided for Hispanic students, many of whom are first-generation college students;

and these workshops showcased an invited speaker to provide information about different career choices students might consider upon graduation.

Project CASC-aid.

This project addresses two general issues interfering with our nation's STEM progress. First, the project team developed multiple elements to support Hispanic students toward a college degree in a STEM field, including a variety of success mechanisms, one of which is the aforementioned Student Success Workshops. The outcomes of the Student Success Workshops will be addressed in this paper. However, there are a host of other supports provided to CASC-aid scholars. To address support for students' lack of college knowledge, student mentoring is key.

Enriquez (2011) noted that first-generation Hispanic college students need to know about college readiness and attainability. Presently, first-generation college students remain far behind their peers in college readiness (act.org, 2016; NAEP, 2016; Viadero & Johnston, 2000). Hispanic students face many barriers when considering college, including difficulties in: (a) navigating through college applications, (b) filling out financial aid packets, and (c) overcoming cultural barriers. Individuals who have lived those experiences can best address these complications. The South Texas borderland region is rich in mentoring potential. Successful college graduates who reside in the area can often be the best mentors for first-generation college students (Enriquez, 2011). CASC-aid experts in the field have enlisted a network of mentors who will guide students into post-secondary, academic success.

Next, a strategic directive at retaining students was also key for Project CASC-aid. Retention strategies for CASC-aid scholars are holistic and layered. Primarily, the project will build community among and across each cohort of scholars. Research on Residential Colleges supports the potential success of the College Algebra Course (Tinto, 2012). And, this particular aspect has been proven successful under the direction of the third author/co-PI in 2011, with a central Texas high school group. In addition, cohorts will be defined by the mathematics courses, as enrollment in a CASC-aid mathematics course is a requirement of scholars. Other aspects of Project CASC-aid rely on Communities of Practice (Lave & Wenger, 1991) that are built by Community Tutoring and Success Workshops. All CASC-aid scholars, regardless of which mathematics course they are in, will be able to attend Community Tutoring, which includes regularly scheduled tutoring time facilitated by the PI and fourth-author/co-PI.

Finally, the project team designed the Student Success Workshops to support college knowledge (Conley, 2007) and STEM job knowledge for CASC-aid scholars. Examples of workshop topics supplying students with college knowledge included: (a) "Building and Writing a Resume"; (b) "Understanding the GRE"; and, (c) "Panel: Hispanics in STEM Professions". University and CASC-aid representatives were on hand to provide updates on advising, internships, and financial aid deadlines to further support scholars. To enhance students' job knowledge in STEM fields, the PI invited STEM Researchers/Intellectuals in their respective fields to present career opportunities that students may be unaware of as a long-term job goal. These workshops focused on a variety of strategies to support scholars, and all workshops included mentoring activities and opportunities.

The elements of Project CASC-aid have cultivated a positive, synergistic STEM community with clear lines of communication to ensure CASC-aid scholars are supported in all

endeavors they undertake. Communication is a key function of this project, and it is necessary to ensure CASC-aids scholars receive full benefit of the supports available to them.

Literature Review

In a search of the ERIC (EBSCO) database using the keywords Hispanic, undergraduate, STEM, and supports, 14 articles were retrieved. The number dropped to seven articles when a criterion for peer reviewed manuscripts was entered. Of those seven, several articles described successful programs with targeted interventions to retain Hispanic students toward degree completion. First, Carpi, Ronan, Falconer, Boyd, and Lents (2013) described a series of targeted supports for retaining students at Hispanic Serving Institutions (HSIs). Supports included: (a) a math and science resource center; (b) paced science courses; (c) faculty development seminars; (d) math/science curricular alignment; and, (e) department student science awards. Efforts led to increased graduation rates for Hispanic students in Forensic Science (Carpi et al., 2013).

Slovacek, Whittinghill, Flenoury, and Wiseman (2012) examined “programs funded by the National Institutes of Health Minority Opportunities in Research (MORE)” (p. 199) and determined that students supported by the MORE program graduated more quickly with higher GPAs, and many more entered a graduate program. Slovacek et al. (2012) reviewed eight years of student data from participants in MORE and non-MORE schools, comparing several models, including Tinto’s (1975) and Swail’s (2003) Model. Students in the MORE program were highly successful. In their discussion, Slovacek et al. (2012) noted that “results of the study then lend credence to the hypothesis that an institution, through a range of interventions aimed at supporting different aspects of the student experience, can have a dramatic impact on the outcomes of students traditionally underrepresented in the sciences with respect to graduation and the pursuit of advanced degrees” (p. 213).

Notably, a phenomenological case study by Sriram and Diaz (2016) collected data on 13 minority students’ perceptions of their STEM identity as part of a Living-Learning program while attending a predominantly white university. Students’ responses were positive and students felt that they were part of a family. Surprisingly, “all participants agreed that they felt more of a minority as a STEM major on campus as a whole than they did as a student of color” (Sriram & Diaz, 2016, p.14). Authors suggested more qualitative research to delve into minority students’ as STEM majors. Flower (2014) described how HSI’s support students in STEM areas. Likewise, Jackson, Starobin, and Laanan (2013) noted that women and underrepresented minorities must have support from colleges and universities to be successful in STEM areas, a traditionally white, male field.

Minority students often need support to be successful in college; and when considering first-generation Hispanic students majoring in a STEM field, support mechanisms to ensure successful degree completion is vital. Project CASC-aid provides multiple supports for scholars, and the Student Success Workshops provided a layer of support to ensure students were familiar with a variety of options, post-graduation, for career fields.

Method

With Internal Review Board (IRB) approval, the PI and co-PIs conducted an exploratory study from October, 2017 through October, 2018 utilizing a formative experiment (Reinking & Bradley, 2008) to determine the effects of Student Success Workshops on CASC-aid

scholars' awareness of prospective jobs, post-graduation. Formative experiments align with design-based research (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). The first author/co-PI selected a framework outlined by Reinking and Bradley (2008) that included six components to guide the project team toward achieving the selected goal of increasing CASC-aid scholars' knowledge of jobs in STEM fields prior to graduation through Success Workshops. The project team followed these six components when beginning this exploratory study:

- (1) select an important goal undergirded with theory and prior research;
- (2) identify research and theory to assist with achieving the goal;
- (3) collect data on aspects that enhance and/or diminish achievement of the goal;
- (4) modify the intervention to make it more appealing to all stakeholders;
- (5) anticipate positive and negative changes that the intervention produces; and,
- (6) identify changes that have occurred as a result of the intervention.

The goal identified in this formative experiment was to increase STEM majors' understanding of career opportunities, post-graduation, through Student Success Workshops. Unlike other methodologies, which identify a research question or hypothesis, a formative experiment sets a desired goal that if achieved, will have consequential validity (Gravemeijer & Cobb, 2006). It was important to the project team that future job prospects were clearly and effectively articulated to CASC-aid scholars while still enrolled in college. In this manner, students might choose to: (a) streamline a degree; (b) change a major from engineering to math, or math to science, and other; and/or, (c) intern with a professor or employer in an area that interests them as a future job.

To determine the effectiveness of the Student Success Workshops geared toward job knowledge, the first author developed a Likert survey (Figure 1) consisting of 18 questions. Students had five options when responding to survey statements: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). After analysis of survey instruments, it was determined that the Student Success Workshops were well-received by scholars and are an effective support for students as they move closer toward their goal of graduating with an undergraduate degree in a STEM field.

- A) This workshop was beneficial.
- B) The speaker was motivating.
- C) I learned about a new career option.
- D) This was a mandatory workshop.
- E) I want more workshops like this one.
- F) Other CASC-aid scholars would benefit from this workshop.
- G) Workshops offered through CASC-aid support my learning as a STEM student.
- H) After this workshop, I am thinking about other career options.
- I) The CASC-aid program is supportive.
- J) I attend every workshop offered to CASC-aid scholars.
- K) I attend every study session with the graduate assistants.
- L) I am being prepared for a career in a STEM field as a CASC-aid scholar.
- M) This workshop was not beneficial to me.
- N) Upon graduation, I will seek a job in a math related field.
- O) Upon graduation, I will seek a job in a science related field.
- P) Upon graduation, I will seek a job in an engineering field.
- Q) I need to meet with my advisor more often.
- R) This workshop was directly related to a career I am considering after graduation.

Figure 1: Researcher-developed survey instrument

Participants and Setting

Across 2017-2019 academic years, CASC-aid scholars attended multiple Success Workshops to hear guest speakers describe their STEM research and/or area of expertise. CASC-aid scholars attended workshops on campus in rooms where they regularly attend STEM classes. The number of participants attending each of the workshop varied in size, with a range from 6 participants to 32 participants. Student participants' gender, major, class standing, and anticipated graduation date varied with each workshop (Table 1).

Table 1: Information on workshop participants

Date	October, 2017	November, 2017	January, 2018	February, 2018	October 3, 2018	October 18, 2018
Participants in attendance	32	14	16	12	6	8
Male	80%	78%	80%	75%	66.7%	50%
Female	20%	22%	20%	25%	33.3%	50%
Freshman	0%	7%	0%	0%	0%	0%
Sophomore	6%	29%	18%	0%	16.7%	25%
Junior	19%	43%	32%	30%	0%	12.5%
Senior	75%	21%	50%	70%	83.3%	62.5%
Engineering	81%	64%	75%	63.6%	100%	50%
Math	12%	14.3%	25%	36.4%	0%	50%
Science	6%	21.4%	0%	0%	0%	0%
Hispanic participation	100%	100%	93.8%	91.7%	100%	100%

The six Student Success Workshops were entitled: (1) "System Dynamics Simulation Modeling"; (2) "Drilling Optimization and Drill Stem Vibration Modeling"; (3) "Vectorborne Diseases and Prevalence in South Texas Region"; (4) "The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement"; (5) "Current Memory Technology Trends; and, (6) "Weak Galerkin Finite Element Method with Mixed Boundary Conditions". Sessions lasted approximately one hour and included a question and answer session at the end to support effective communication for scholars. Students filled out Likert-scale surveys based on their experience with the speakers and/or content of workshop.

At all workshops, 100% of students identified as Hispanic/Latino except for the third and fourth workshops, with one student identifying as Asian/Pacific Islander at each session.

Materials and Procedure

The PI and co-PIs working on this project are committed to ensuring that scholars attain maximum benefit from all supports provided through Project CASC-aid and the survey instrument developed by the first author was an attempt to better understand whether information provided by invited speakers at Student Success Workshops was helpful and meaningful for scholars as they move forward in the program. The PI/second author wanted to ensure students learned about a variety of career fields that might be unfamiliar at this stage in their academic careers and the first author/co-PI wanted to determine if scholars were, in fact, unfamiliar with a potential career option. CASC-aid scholars received information, handouts, and contacts to further support effective communication. At the end of each workshop, scholars received a survey to fill out. All surveys were anonymous, and no identifying markers to match a particular student with the information he/she provided was available during analysis of data. The first author was not present at workshops or when students filled out surveys. The PI handed out and collected all surveys, and subsequently sent them to the co-PI after they had been completed. Surveys were developed by the first author, and validity and reliability of the survey instrument is ongoing. Controlling variables such as location, length or workshop, and presentation style of workshops is one component used to increase validity. Increasing randomization of sample of CASC-aid participants is done through changing the time of the workshop to ensure participants' schedules don't interfere with their ability to participate in workshop.

Results

After data analysis from six sets of surveys, researchers determined that Student Success Workshops provided an effective support to build job knowledge for CASC-aid scholars. Responses to survey items were positive (Table 2), although there was some confusion among scholars as to whether the workshops were mandatory.

Table 2: Student-participants' responses to survey items one, two, and three

Survey Question One: This workshop was beneficial.					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	29%	39%	19%	9%	3%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	57%	36%	0%	0%	7%

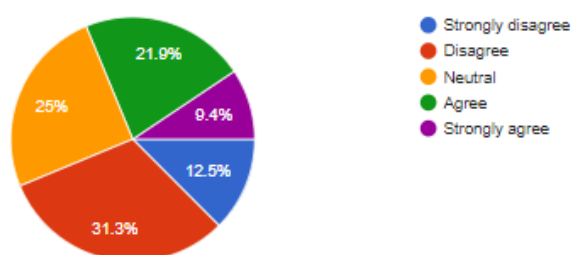
Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	50%	31%	0%	0%	19%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	25%	33.3%	33.3%	0%	8.3%
Workshop Five: Current Memory Technology Trends	50%	50%	0%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	50%	37.5%	12.5%	0%	0%
Survey Question Two: The speaker was motivating					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	34%	19%	31%	13%	3%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	36%	50%	7%	7%	7%
Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	25%	56%	12%	6%	0%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	50%	16.7%	33.3%	0%	0%
Workshop Five: Current Memory Technology Trends	66.7%	33.3%	0%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	25%	50%	25%	0%	0%
Survey Question Three: I learned about a new career option					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	16%	34%	25%	20%	6%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	29%	64%	0%	0%	7%
Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	12%	25%	31%	19%	13%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	16.7%	41.7%	25%	8/3%	8.3%
Workshop Five: Current Memory Technology Trends	33.3%	33.3%	33.3%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	25%	12.5%	50%	0%	12.5%

Survey results based on question one demonstrate that most students believed workshops were beneficial, with more than half of scholars selecting agree or strongly agree across all speakers. The second, third, and fifth workshops had the highest percent of students being motivated by the speaker. As a result, the PI and co-PIs would recommend speakers with knowledge on Drilling Optimization, Vectorborne Diseases, and Technology Trends as more beneficial for STEM students. The third item, “I learned about a new career option” provided an immediate response for the research team. This survey item, in particular, will aid the project team in identifying STEM scholars to speak at workshops.

When students’ responses on the first three questions were compared, the most successful workshop in terms of guest speaker was the second workshop, in which students were introduced to “Drilling Optimization and Drill Stem Vibration Modeling”. Likewise, the second workshop introduced 93% of CASC-aid scholars to a new career option. This study took place in south Texas, and oil is a big industry in the state so this guest speaker effectively communicated potential career options to students that they may not have been aware of and/or considering. However, question eight, “After this workshop, I am thinking about other career options”, provided mixed results. Students across all six workshops were considering other career options after listening to invited speakers (Figures 2, 3, 4, 5, 6, & 7); but, it was after the fourth and fifth workshops that the largest percentage of students attending the presentation were considering a career change.

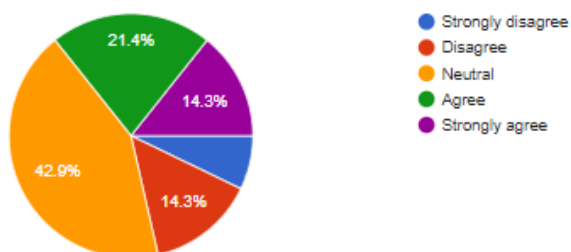
After this workshop, I am thinking about other career options.

32 responses



After this workshop, I am thinking about other career options.

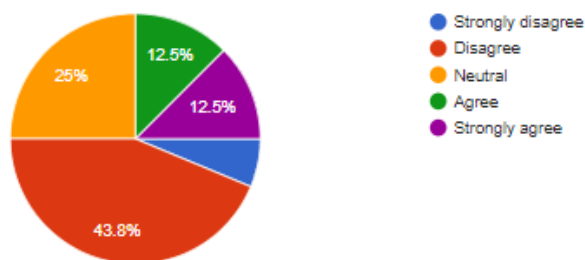
14 responses



Figures 2 and 3: Students considered a career path change-Workshops one and two.

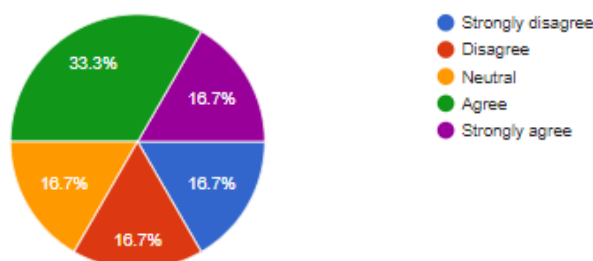
After this workshop, I am thinking about other career options.

16 responses



After this workshop, I am thinking about other career options.

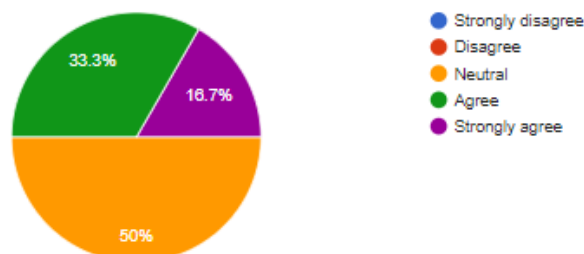
12 responses



Figures 4 and 5: Students considered a career path change -Workshops three and four.

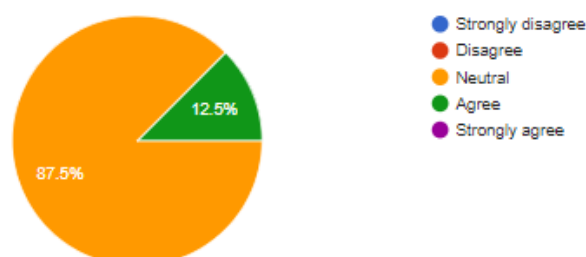
After this workshop, I am thinking about other career options.

6 responses



After this workshop, I am thinking about other career options.

8 responses



Figures 6 and 7: Students considered a career path change-Workshops five and six.

Questions five through seven (Figure 1) were developed to determine students' beliefs about supports CASC-aid scholars received from workshops. Students' responses on statements five through seven were higher for some workshops. For example, for the statement "I want more workshops like this one", workshops two and five received the strongest number of students selecting A or SA: 56.3%, 92.8%, 87.6%, 54.6%, 100%, & 62.5% with scores across all six workshops mostly positive respectively. On the statement "other CASC-aid scholars would benefit from workshops", students again responded SA or A in moderate to high percentages: 75%, 78.5%, 81.3%, 58.3%, 83.4%, & 62.5%. Finally, on the statement "workshops support my learning as a STEM student", students who selected A or SA was high across all six workshops respectively: 81.3%, 78.6%, 75.1%, 91.7%, 100%, & 100%.

Students selected A or SA that the "CASC-aid program is supportive" (90%, 78.6%, 100%, 83.4%, 100%, & 100%) and that they are "being prepared for a career in a STEM field as a CASC-aid scholar" (65.7%, 50%, 93.6%, 91.6%, 100%, & 87.5%) across the six workshops respectively. Notably, after workshop two, half of students did not believe they were being prepared for a STEM career; this might be explained because the guest speaker and topic were new for the majority of students. Furthermore, students may have felt underprepared after listening to a speaker talk about a career with which they were unfamiliar. Students may need additional support to ensure they feel they are being prepared for a career in a STEM field, especially if speakers are presenting new and possibly challenging career options that overwhelm undergraduate students.

Discussion and Recommendations

The use of Student Success Workshops to support Hispanic students majoring in a STEM area at the undergraduate level demonstrated a positive effect on student participants' learning. This formative experiment (Reinking and Bradley, 2008) was an exploratory study that is part of a larger research study to determine the effectiveness of interventions provided by Project CASC-aid to support Hispanic students majoring in STEM fields. During success workshops, students: (a) learned new information, (b) considered new career options they were unfamiliar with prior to invited speakers, and (c) received effective communication and supports from researchers/intellectuals in STEM career fields.

Recommendations include replication of Student Success Workshops to add to the knowledge base. More qualitative data would be beneficial; and data should include interviews with students before they have attended any workshops, and interviews after they have attended three or more workshops. Interviews might provide more relevant data about students' responses to workshops and benefits they believed they received by attending. Similarly, students might provide researchers with their thoughts on drawbacks of the workshops or provide input for future speakers/topics. Overall, the workshops were seen to be beneficial.

Conclusions

Analysis of results were encouraging, but there are several limitations in this study. First, the survey instrument itself is a limitation. The instrument was developed by the first author and multiple CASC-aid scholars were taking the survey on one, two, or more occasions. A second limitation was time involved. This data was collected via researcher-developed surveys, and although data collection and analysis took place over twelve months, the cumulative time students spent in workshops was approximately six hours. A third limitation was the

difference in the number of students attending and/or taking the survey after each workshop. The first workshop was heavily attended. Several of the other workshops were not so well attended. Nevertheless, collecting data on students' attitude toward speakers and topics is relevant. Overall, results demonstrated a level of success that was desired; and the positive outcomes brought about by the workshops as demonstrated by students' responses on the instrument is important. Students felt that they were being supported by the workshops. Likewise, data analysis determined that multiple students were exposed to career choices that they were unfamiliar with prior to listening to invited speakers.

For this investigation, students' responses to the developed Likert survey provided the project team with vital information in planning for future workshops, including: (a) guest speakers' area of expertise, (b) when to offer workshops, and (c) supporting students' long-term career choices. Furthermore, the goal of this formative experiment, to "Increase STEM majors' understanding of career opportunities, post-graduation, through Student Success Workshops" was achieved; and many of the workshops provided CASC-aid scholars with new knowledge for a potential career choice. Furthermore, the developed survey instrument provided information that will guide the project team in selecting speakers for future workshops. Although these workshops were one of multiple, on-going support mechanisms provided to Hispanic students majoring in a STEM field, results demonstrated that the Student Success Workshops were largely successful. PI and co-PIs on Project CASC-aid will continue to gather data from all support services to ascertain which supports are most beneficial in supporting first-generation, Hispanic students in completing an undergraduate degree in a STEM field. This is especially important for this student population. Overall, it is vital to identify speakers for success workshops who will effectively communicate and engage college students considering career options post-graduation from a STEM field.

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**Exploring the Relationship between Science Content Knowledge and Science Teaching
Self-Efficacy among Elementary Teachers**

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Abstract

Elementary school teachers are commonly known to have low self-efficacy in mathematics and science. Previously conducted research on science teaching self-efficacy and content knowledge has often focused on whether methods courses, professional development or other interventions improve both self-efficacy and content knowledge among elementary teachers. This study investigated whether teachers' knowledge of science content influenced their levels of self-efficacy, and compared teachers' who were in a STEM education graduate degree program to teachers and students in a regular elementary teaching program. The participants of this study were 82 in-service and 27 pre-service elementary teachers in affiliation with a large northeastern university. The participants completed a science self-efficacy survey (STEBI-B) and a science content knowledge survey called the Science Beliefs Tests. The results of this study found that pre-service teachers had a higher self-efficacy score in comparison to in-service teachers. Most participants were able to answer a little more than half of the Science Beliefs questions correctly. Additionally, there was a negative relationship between one's belief that they could teach science effectively and their Science Beliefs score, meaning that the more science self-efficacy they possessed, the lower their science knowledge. It is important that teachers become aware of their lack of content knowledge in order to remedy the insufficiency, and to avoid passing along misconceptions to their students. If teachers believe that they have high self-efficacy, they may not be aware that they must continually improve their science content knowledge. Accordingly, teachers can benefit from continued education in topic areas where they scored the lowest.

Keywords: Elementary teachers, science teaching, self-efficacy, science beliefs, misconceptions about science, pedagogical content knowledge

Introduction

Self-efficacy is a person's confidence in his or her ability to complete tasks to the highest potential to attain certain goals (Bandura, 1997). In the field of education, educators have certain beliefs about their abilities and skills as teachers, which can affect their successes in teaching. Many factors can influence a teacher's self-efficacy such as training, preparation, and studying at a higher education level before they begin teaching in a classroom. However, knowledge of science among elementary schools is notoriously low and self-efficacy for teaching the subject may be low as well. This study sought to investigate the relationship between science teaching self-efficacy (STSE) and science content knowledge among both pre-service and in-service elementary school teachers. This study also examined whether a graduate program intended to train elementary teachers to be science specialists improved science teaching self-efficacy and content knowledge.

If teachers are educated properly in science content and science teaching methods, they will have high levels of scientific literacy and scientific knowledge which will allow for high levels of self-efficacy (Al Sultan, Henson, & Fadde 2018). The research on the STSE of elementary teachers is vast and wide. Some of the research indicates that a teacher's self-efficacy is not related to their content knowledge, although it is an important factor in defining expectations of their students. Teachers with high levels of self-efficacy tend to make use of highly effective teaching strategies, are usually more dedicated to the profession of teaching, and are less likely to burn out (Woolfolk, Hoy & Davis, 2006; Zee & Kooman, 2016). In a synthesis of 40 years of self-efficacy research, Zee and Koomen (2016) reported that teacher self-efficacy in general is positively related to student achievement, teacher well-being and classroom quality (e.g., a supportive environment), among other variables. Many of the studies reviewed below have shown that interventions to increase science knowledge and self-efficacy have been shown to be effective. Accordingly, this study sought to investigate the relationship between science content knowledge and STSE among pre-service and in-service elementary teachers. The authors hypothesized that with more years of experience, in-service teachers would likely have more science content knowledge and higher STSE than pre-service teachers. Lastly, we sought to determine whether students who graduated from a master's degree program specifically designed to train elementary teachers to be STEM specialists, with an emphasis on engineering design, had higher STSE or science content knowledge than teachers and students in a regular elementary education program. The implications for this research can inform program development and professional development for teachers.

Science Teaching Self-Efficacy of Pre-Service Teachers

Many studies have examined the impact of methods courses, professional development, extra science courses, or other science learning experiences on STSE of pre-service teachers (Avery & Meyer, 2012; Bergman & Morphew, 2015; Lumpe, Czerniak, Haney, & Beltyukova, 2012). For example, Morrell and Carroll (2003) administered the STEBI-B (used in most of the studies of STSE in this literature review) to students before they engaged in the aforementioned interventions and after. No changes in their STSE during the science courses or students' teaching were found, however significant gains were demonstrated for students in the science methods course likely due to the design of the course. Similarly, Settlege, Southerland, Smith, and Ceglie (2009) also found high levels of STSE, but given that students already possessed high confidence in their abilities, the authors found that students did not modify their instructional practices over time. Menon and Sadler (2017) suggest that students benefit the most by taking science courses with inquiry based teaching strategies,

although low STSE students benefit from proper pacing of the courses. Similarly, through ethnographic research, Jung and Tonso (2006) found that pre-service teachers responded positively to non-threatening, hands-on experiences providing implications for course design for the future. Knaggs and Sondergeld (2015) note that positive impacts from these interventions are likely due to modelling the instructor's method of teaching.

In order to understand and resolve public issues, society needs to be scientifically literate. This means that individuals need to be informed and develop a scientific background. Science teachers play an essential role in educating society about how the world works. Al Sultan et al (2018) argued that pre-service teachers enter the teaching field with low self-efficacy beliefs. In their study, 49 pre-service elementary teachers in an introductory or advanced science methods course completed a survey assessing their scientific background. They also completed the Test of Basic Scientific Literacy (TBSL), Science Teaching Efficacy Belief Instrument (STEBI-B), and Beliefs about Teaching (BAT) as further assessment. Al Sultan et al found that pre-service elementary teachers had satisfactory scientific literacy levels and in both methods classes, the participants demonstrated higher self-efficacy in teaching biology and lower self-efficacy in teaching physics. The authors also found a positive relationship between scientific literacy and self-efficacy in advanced pre-service elementary teachers because of the amount of exposure to scientific courses.

Science is often not a priority in elementary classroom instruction, although with the adoption of the Next Generation Science Standards (NGSS) in most of the United States, increased focus on teaching science through inquiry will need to be integrated into the curriculum. Accordingly, Grinell and Rabin (2017) developed a study with the goal to motivate 59 pre-service elementary teachers in a science methods course to spend a significant amount of time teaching science in their future classrooms, even if they have demonstrated low STSE. The findings from their study indicated that helping pre-service teachers find the connections between science knowledge and ethics helps shape their beliefs in a way that can motivate them to improve their level of science knowledge. By improving their knowledge of science, they can teach their students more often and more effectively. At the end of the semester, almost every participant was better able to discuss the ethics and equity in the context of science teaching. As noted previously, many pre-service elementary education teachers have low levels of proficiency and interest in science, which can lead to a failure to make science a priority in the curriculum (Cervato & Kerton, 2017). Interventions such as requiring extra science courses in the pre-service teacher curriculum, participating in authentic science experiences using inquiry based activities (Avery & Meyer, 2012), and providing supportive settings in which the pre-service teacher is provided consistent and constructive feedback can improve self-efficacy and science knowledge (Knoblauch & Hoy, 2008).

In-Service Teachers' Science Self-Efficacy

In-service teachers have more work experience in the field, but that does not mean they are comfortable when it comes to teaching science topics. Lumpe et al (2012) investigated whether there was an effect on elementary students who are educated by confident teachers who believe in their own abilities. The researchers also investigated whether a summer professional development program, focusing on science content knowledge, for 450 elementary science teachers would affect their beliefs about teaching. During the school year, teachers were provided with support to help with professional development and science content. Both teachers and principals received additional professional development. The researchers measured the teachers' knowledge of science concepts before and after the

program. They then compared the teachers' knowledge to that of 580 fourth graders and 1,369 sixth graders, using the Ohio state achievement test for science. The results showed that the program increased the positive beliefs the science teachers had about their own teaching. The researchers also found that teacher STSE and at the number of professional development hours they attended contributed to student achievement.

Unsurprisingly, in-service teachers can also benefit positively from an increase in exposure to content-specific knowledge. Swackhamer, Koellner, Basile, and Kimbrough (2009) researched the effects of content-specific courses in math and science over a five-year period on 277 teachers' self-efficacy. At the end of each course, the teachers were asked to complete a self-efficacy survey (STEBI- B), although only 88 teachers completed the survey. The results showed that the mean scores of teachers who took more than four of the courses had a significantly higher Science Teaching Outcome Expectancy (STOE) and levels of efficacy than the teachers who took fewer than four of the courses. STOE describes the general factors that teachers believe will impact student science ability. The teachers initially had low STSE due to their perceived low level of content knowledge. While the literature on in-service and pre-service teacher science self-efficacy is large, few studies compare the STSE of in-service to that of pre-service teachers, nor have any studies compared the relationship between STSE and science content knowledge among these two groups.

Science Misconceptions and Content Knowledge Among Teachers

Research has suggested that students hold many misconceptions when it comes to science concepts and content (e.g., Bar, Brosh, & Sneider, 2016; Tompo, Ahmad, & Muris al, 2016). Educators, elementary teachers in particular, often focus on those misconceptions to guide their teachings. However, research suggests that educators also hold science misconceptions, and these misconceptions negatively impact their teaching. Several studies have shown that teachers and students tend to hold the same misconceptions and that they are mostly in the physical sciences (Burgoon, Heddle, & Duran, 2011; Bursal, 2012; Stein, Larabee & Barman, 2008).

Similar to the present study, Kirik (2013) examined the relationship between STSE, participation in extracurricular activities, science content knowledge, number of science and methods courses taken, as well as classroom management and efficacy beliefs. Seventy-one secondary science education majors and 262 pre-service elementary teachers participated in the study. The results indicated that there was a small significant relationship between science knowledge and outcome expectancy. Both groups had positive STSE, although secondary science majors had higher STSE than elementary majors.

Although studies have investigated the impact of different types of interventions on both content knowledge and STSE, none have assessed both constructs among both pre-service and inservice teachers. Many of the interventions were methods courses taken by all elementary education teachers, or were one-time programs offered over a period of time. This study extends the previously conducted research by examining a longer term intervention: a graduate degree intended to train elementary teachers to be STEM specialists. The authors hypothesize that teachers in (or have graduated from) the STEM graduate program possess greater STSE and content knowledge over other in-service teachers.

Methods

This study sought to answer the following research questions:

- To what extent is there a relationship between STSE and science content knowledge?
- Is there a difference in both constructs among pre-service and in-service teachers?
- Is there a difference in both constructs among teachers training to be science/STEM specialists and those who are non-specialists?

Participants

After receiving Institutional Review Board approval to conduct this study, in-service and pre-service elementary teachers were emailed an invitation to participate in the study which included a link to a science self-efficacy survey and science content knowledge survey.

Participants included undergraduate pre-service teachers enrolled in a teacher education program at a large private university on Long Island, NY, and in-service teachers enrolled in graduate programs in the same university. Some participants had recently graduated from the graduate program, which is a master's degree in elementary STEM education in which students are trained to be STEM specialists. Additionally, elementary teachers in partner districts with the university were invited to participate in the study.

Measures

In order to measure STSE, the STEBI-B was administered. The STEBI-B is one the most frequently used measures of STSE. It is relatively brief and has demonstrated reliability and construct validity consistently. The STEBI-B was developed by Riggs and Enochs (1990) to assess the science teaching self-efficacy of pre-service teachers. Because we administered the survey to both pre-service and in-service teachers, we chose the STEBI-B as opposed to the STEBI-A which was intended for in-service teachers only. The STEBI-B includes 23 items on two subscales: Personal Science Teaching Efficacy Belief (PSTE) and Science Teaching Outcome Expectancy (STOE). The PSTE primarily assesses the degree to which participants believe that they, as educators, can impact student achievement in science, whereas the STOE demonstrates participants' beliefs about the general factors that might impact a student's science achievement. Items were answered using a 5-point Likert scale from strongly agree to strongly disagree. Two items in particular tend to cross-load onto both factors and to exhibit low loadings. Bleicher (2004) revised the wording of the scale, although as reported below those two items still proved problematic in this study as well. Those two items are "The low science achievement of some students cannot generally be blamed on their teachers" and "Increased effort in science teaching produces little change in some students' science achievement" (Bleicher, 2004, p. 391). Riggs and Enoch (1990) reported an internal consistency reliability, using Cronbach's alpha (CA), with a score of .76, while Bleicher (2004) found a CA of .72.

The Science Beliefs Test was administered to assess the science content knowledge of teachers. The Science Beliefs Test was developed by Larrabee, Stein, and Barman (2006). The test was intended to be administered via computer and includes a 44 item true/false test that was constructed based on common misconceptions that teachers, and people in general, have about life science, earth science and physical science concepts. The items on the test reflect knowledge that the average adult should possess about science concepts. The original version of the test asks participants to explain their answers so that the researchers could determine whether participants actually understood the concept being tested. For this study, we only asked participants to mark whether they believed a statement to be true or false.

Larrabee et al determined the internal consistency reliability, using Kuder-Richardson, to be a value of .77. They also determined test-retest reliability was .776. We report our own reliability statistics for both measures below. The online version of the Science Beliefs Tests may be found here <https://www2.oakland.edu/secure/sbquiz/>.

We also added additional questions about whether participants were pre-service, in-service, secondary or elementary level, in the STEM MA graduate program (the program at our institution in which elementary teachers are trained to be science specialists) or whether they were employed as science specialists. We also asked about the highest educational level attained. After data were collected and coded, they were analyzed using SPSS v. 23.

Results

Participants

A total of 144 participants took the survey, although only 109 of those surveys were completed. The 35 participants who did not complete the surveys, did not complete the Science Beliefs portion of the survey. Of the 109 participants, 82 were in-service teachers, while 27 were pre-service. Of the 82 in-service teachers 28 had been trained as STEM specialists. We did not ask participants about their gender or ethnicity. Because most of the participants were graduates of our institution's program, we were aware that at least 90 percent of participants were white females. Eight participants were special education teachers, and 13 were employed as elementary STEM specialists.

Reliability and Validity of the Measures

The full STEBI-B demonstrated a reliability of a CA of .856, while the subscale STOE had a CA of .685, and the PSTE had a CA of .896. These values show that the scale demonstrated good reliability. Principal components analysis using varimax rotation revealed six factors demonstrating eigenvalues greater than 1, with the entire model explaining 64.5 percent of the variance. When forcing the items into two factors (representing the two subscales), all of the items, other than 10 and 13, loaded onto the two appropriate factors explaining 39.5 percent of the variance. However, items 10 and 13 loaded at .258, which is below the .5 cutoff. These two items had been noted as problematic previously by Riggs and Enochs (1990).

Science Teaching Self-Efficacy Scores

STSE total and subscale scores were computed for each group. Comparisons among groups were also calculated. The mean STSE total score was 48.48 (standard deviation of 9.14). As can be seen in Table 1, there were few differences among groups in STSE total scores between STEM MA students and non-STEM MA students. Pre-service teachers ($n = 27$) did demonstrate higher STSE scores than in-service teachers trending significant where $p = .06$, $F = 3.459$ (1, 282.7). In general, when considering the different range of scores for each subscale, participants STOE (with a range of 0-65) scores were lower than their PSTE (a range of 0-50) scores. The average STOE score for all participants was 23.97; for the PSTE the mean was 24.58.

Table 1: Mean total and subscale scores on STSE and Science Beliefs for all groups.

	Range of scores possible	Pre-service (n = 27)	In-service (n=82)	STEM MA (n= 81)	Non-STEM MA (n= 28)	Total (n = 109)
STSE mean Total Score	0-115	51.34	47.55	49.29	48.29	48.48
STOE	0-65	24.59	23.77	24.10	23.93	23.97
PSTE	0-50	26.58	23.88	25.07	24.34	24.58
Science Beliefs Total	0-44	24.74	25.04	25.04	24.93	24.99
Life Science	0-11	6.81	6.76	7.00	6.70	6.78
Physical Science	0-16	9.93	10.13	10.18	10.01	10.1
Earth Science	0-14	7.67	7.85	7.68	7.85	7.80

When looking at the differences between participants on their current teaching status: pre-service teacher, in-service general elementary, and in-service STEM elementary teacher, those employed as STEM elementary teachers scored significantly lower than general education teachers on the STEBI-B, at the $p < .05$ level. STEM elementary teachers had a mean score of 41.23, while general education teachers had a mean score of 49.10. When compared to pre-service teachers, STEM elementary teachers scored significantly lower at the $p < .001$ level, where pre-service teachers had a mean score of 51.34.

Science Beliefs Test scores

The mean raw score on the Science Beliefs Test was 24.99 out of 44. When converted to a percentage, the mean total score was 56.73%. There were no significant differences between pre-service and in-service teachers on the Science Beliefs test or any of its subscales. The same is true for STEM MA students as compared to non-STEM MA students. There were also no differences between STEM teachers, general education teachers on the Science Beliefs Test. Students tended to get a little more than half of the questions correct on all of the subscales.

Students tended answer life science questions correctly more often with a percentage of 62 correct. In the physical sciences, on average they scored 59 percent correct, although students in the STEM MA program scored higher at 64 percent. Students scored the lowest on the Earth science questions at an average of 49 percent correct for all participants. (See Table 2).

Table 2: Scores on Science Beliefs converted to percentage correct for all groups.

	Range of scores possible	Pre-service (n = 27)	In-service (n=82)	STEM MA (n= 81)	Non-STEM MA (n= 28)	Total (n = 109)
Science Beliefs Total	0-44	54%	57%	57%	57%	57%
Life Science	0-11	61%	61%	64%	61%	62%
Physical Science	0-17	58%	60%	64%	59%	59%
Earth Science	0-16	48%	49%	48%	49%	49%

Analysis of responses to individual Science Beliefs Test items showed that on many items half of the respondents answered the questions correctly. For example, question two states “Plants use oxygen.” Only 50 percent of participants indicated that this statement was true. Another trend that we noted was that a large majority of the participants (75 percent) chose the incorrect answer to the question 1 which stated that “The only essential constituents that plants need in order to grow are: water, light and nutrients from the soil or medium in which they exist.” The correct answer to this question is false, because plants also need air, as at least half of the participants indicated in their answer to question 2. In another example, question 13 states, “An astronaut is standing on the moon with a baseball in his/her hand. When the baseball is released, it will fall to the moon’s surface.” Only 29.13 percent of participants accurately responded that this statement was true.

We also sought to determine whether there was a relationship between science content knowledge and STSE. A Pearson’s Product Moment correlation showed a negative, moderate, significant relationship between STSE and total Science Beliefs score was $r = -.281$ $p < .01$. Further analysis shows that the Science Beliefs scores was, negatively related to the PSTSE subscale $r = -.297$. Overall, these results suggest that the higher a participant’s science teaching self-efficacy, the lower their content knowledge.

Discussion

This study sought to determine whether, and to what extent, there is a relationship between science content knowledge (as measured by the Science Beliefs Test; Larrabee et al, 2006) and science self-efficacy. We also sought to determine if there were differences on these measures between in-service and pre-service teachers, as well as between graduate students (who are in-service teachers) training to be science specialists (in the STEM MA program) and those not in the STEM MA program. We found that there were differences between pre-service and in-service teachers on the STSE scores. Results were not significant at the $p < .05$ level, but they were trending towards significance at $p = .06$. There was very little difference on science content knowledge between any of the groups we studied. However, we did find a significant negative relationship between STSE and science content knowledge, particularly for one subscale of the STEBI-B. These results indicate that as Personal Science Teaching Efficacy beliefs go up, science content knowledge goes down, meaning that teachers who believe they are able to teach science effectively tended to have lower science content

knowledge. These results indicate that elementary school teachers and those training to be teachers have low content knowledge. They carry the same misconceptions as that of the general public. Further, it is problematic when teachers believe they are effective science teachers but have low content knowledge. Although research notes that teacher self-efficacy is positively related to student achievement (Zee & Koomen, 2016), other researchers noted that teachers with high self-efficacy may be resistant to changing instructional practices because they already have confidence in their pedagogical efficacy (Tschannen-Moran, Hoy, & Hoy, 1998). Most relevant to this study, research conducted by Settlage et al, (2009) of pre-service teachers found that the participants already had high self-efficacy at the pre-test. Since they lacked uncertainty in their teaching abilities they were not open to expanding their knowledge to improve their pedagogical practices. It is important to note that Riggs and Enoch (1990) did not indicate a cut-off score by which to determine whether a participant had high or low STSE. Given that the maximum score one can attain is 115 and that the mean score was 48, we can surmise that the respondents in this study had average STSE.

One positive explanation for the high STSE scores of the pre-service teachers, is that pre-service teachers have been found to become more interested in science through methods courses, which increases confidence in students' ability to teach science topics (Grinell & Rabin, 2017; Menon & Sadler, 2017). By adding additional science courses to pre-service teachers' education programs, pre-service teachers have been found to increase their scientific knowledge and STSE (Avery & Meyer, 2012).

In-service teachers can also benefit from continued teacher training (Lumpe et al, 2012; Swackhamer et al, 2009). One explanation for why in-service teachers had lower STSE is that in-service teachers may be more aware of the subjects they are not the strongest in teaching because of their years of experience. In-service teachers can increase their STSE by participating in more continued teacher training that will provide them with more hours of exposure to the scientific content knowledge that they may not know as well as other subjects.

As reported in the literature, it is not uncommon for in-service elementary school teachers to have low content knowledge in science. Interestingly, our results showed that elementary STEM teachers (that is elementary teachers who only teach science) had significantly lower STSE even though their science content knowledge was on par with the other groups. Their low STSE may be due to the fact that they are "in the trenches" teaching science every day and are aware of their lack of content knowledge, thus propagating low STSE.

Additionally, although we found few differences in respondents' knowledge about life science, Earth science and physical science, other researchers found that most teachers had the highest self-efficacy in teaching biology and the lowest self-efficacy in teaching physics (Al Sultan et al, 2018). Similarly, Burgoon et al (2011) found that students and teachers have the most misconceptions in the physical sciences. In this study, however, participants scored lowest in Earth science concepts.

At the institution in which this study took place, elementary school teachers (both pre-service and in-service) may participate in a program where they train to be science specialists in the STEM MA program. They take additional science and math methods courses, engineering design courses, and often science content courses. Surprisingly, there were no differences between those who were in this program and those who were not studying to be science

specialists. One explanation for these results are the uneven group sizes. There were only 28 students in the STEM program.

Limitations

The most significant limitation to this study was the sample size. A sample of 109 participants does not make this research generalizable to other groups of elementary teachers. This limitation is a common issue among studies of STSE and science content knowledge. Our sample strategies had mixed results, while all participants who were invited to take the survey who were students at the institution (all pre-service teachers and all in-service STEM MA students) participated, there was a low return rate for the in-service teachers invited who were not at the institution. Many participants chose not to complete the surveys likely because they were very long. Future research should employ a random sampling strategy and incentive programs to encourage participation.

There are also ethical issues to consider in the development of this research that are related to the limitations. Because elementary school teachers are known to have low self-efficacy in science and mathematics, it may have been uncomfortable to take a 44 question test on the subject and not receive the correct answers once the survey was completed and submitted. Additionally, it would be helpful for teachers to be aware of the topics in which they could improve knowledge. Given that there is a negative relationship between knowledge of science and confidence, it would be beneficial to both the teacher-participants and their current and future students if teachers are provided with the results of the research. These issues can be remedied by offering professional development to teachers who participated in the study.

Implications and Recommendations

Self-efficacy levels of teachers can affect their ability to be effective in the classroom. Teachers can work towards improving their levels of self-efficacy by allowing themselves to continue to learn through content-specific and inquiry-based courses. Although in-service teachers have more years of teaching than pre-service teachers, in-service teachers need just as much continued education in order to be more successful in the classroom. Universities do, and should continue to develop programs for pre-service teachers that will provide them with more learning experiences in science-based courses so that future teachers can increase their levels of self-efficacy which will lead to their future students to also be more successful in the learning process. Further, relationships between universities and schools can facilitate the improvement of teachers' self-efficacy (Petersen & Treagust, 2014). Future research should expand efforts to collect larger samples of elementary teachers and to connect teacher knowledge to student knowledge. Further, research investigating interventions for improving elementary science content knowledge are needed.

Conclusion

It is important for pre-service teachers to be motivated to take on the responsibility of providing their students with quality science instruction. When teachers do not have high self-efficacy about their ability to teach science, they are less likely to want to dedicate instructional time to science. Teachers can be motivated to have higher self-efficacy in science if they are able to understand ethical issues that probe their interest and create a desire to share the knowledge and importance to their students.

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**Internationalization and English as a Medium of Instruction in Mongolian
Higher Education**

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Abstract

In the growing global trend of internationalization, Mongolian universities plan to increase courses and programs in English in order to improve their competitiveness and ultimately to become internationally visible, at least in Asia. This study discusses the current process of internationalization at Mongolian universities and explores the rationales of implementing English as a Medium of Instruction (EMI) at Mongolian universities. The analysis focuses on how the top-down national-level policies to internationalize the higher education sector influence both national and private universities, and what drives universities to adopt EMI policies. This paper intends to answer these questions through document analysis and an online survey at two private universities in Mongolia. Forty faculty members participated in the survey. All data went through the qualitative document analysis, “describing, classifying and connecting” (Coffey & Atkinson, 1996) to portray a comprehensive picture of the internationalization of higher education and the concept of EMI in Mongolia. The findings revealed that the Mongolian government is the key player in internationalization at the national level by making policies, taking initiatives, and encouraging national universities. However, the process of internationalization is much slower at private universities. The two private universities in Mongolia implement EMI for the following four reasons, 1) increasing the employability of domestic graduates, 2) promotion of international collaboration, 3) generating more income, and 4) increasing domestic and international profile. The faculty members of the two leading private universities understood that the introduction of EMI at their universities aimed to equip their graduates with English language skills to operate globally and to improve their universities’ international profile.

Keywords: English as a medium of instruction, faculty development, international collaboration, internationalization of higher education

Introduction

Internationalization of higher education (IoHE) is not a homogeneous concept but more of a global concept of interrelated dimensions (Hudzik, 2015). Moreover, there is no agreed-upon definition for IoHE. IoHE has many aspects including organized cross-border mobility of students and faculty, foreign language learning, internationalization of curricula, cross-border institutional partnerships in joint research, joint degrees, and branch campuses. Early on, Soderqvist (2002) defined IoHE as

a change process from a national higher education institution to an international higher education institution leading to the inclusion of an international dimension in all aspects of its holistic management in order to enhance the quality of teaching and learning and to achieve the desired competencies (p.29).

However, the most widely used definition is the one put forth by Knight (2003), “Internationalization is the process of integrating an international, intercultural or global dimension into the purpose, functions or delivery of post-secondary education” (p.2). According to Knight (2004), IoHE has two main spheres of action, “internationalization at home” and “internationalization abroad”. “Internationalization at home” applies strategies and approaches designed to utilize an international dimension into the home campus by including global and comparative perspectives in the curriculum or recruiting international students, scholars, and faculty and leveraging their presence on campus. “Internationalization abroad” encourages an institution to send students to study abroad, set up a branch campus overseas, or engage in an inter-institutional partnership (Altbach, Reisberg, & Rumbley, 2009).

Rationales for Internationalization

Rationales for internationalization (Knight & de Wit, 1997; Knight, 2003, and de Wit, 2000) are categorized into four groups; academic, social/cultural, political, and economic. According to Knight & de Wit (1997), rationales can be described as motivations for internationalization and different rationales imply different means and end to internationalization (de Wit, 2000). In addition to the four categories, Knight (2004) added a new category, “branding” and developing an international reputation, particularly through rankings.

Political rationales for internationalization are rooted in the development process of nation-states, and the dominance of European models of higher education in colonies in the Americas, Africa, and Asia (de Wit, 2000). This political rationale was changed when the United States of America gained international power after the Second World War. Universities in the United States started to develop area studies, foreign language training, and study abroad when federal funding supported them. To maintain and expand its influence, America expanded educational and international exchanges (for example, Fulbright). As de Wit (2000) emphasized, the political rationale after the Cold War changed from the political to the economic.

Economic rationales for internationalization have been the driving force for cooperation and exchange in research, technology, and education development programs (de Wit 2000). Economic rationales are pursued due to the increasing global labour force, joint international research and development projects for international competency, and marketing of higher

education on the international market. As Wächter (1999) noted, universities around the world compete to strengthen their income base through the provision of education services to foreign customers. Anglophone countries like the United Kingdom, Canada, Australia, New Zealand, and the United States of America gain more advantage in it. In addition, these countries gain more experience in international marketing strategies to recruit international students through national organizations such as Australia's International Development Program, the Institute of International Education in the USA, and the New Zealand Education Trust. However, other countries focus on international activities such as the opening of distance education programs (van der Wende, 1997) and creation of offshore campuses to attract international students in order to find alternative sources of income (Wächter, 1999).

As for cultural and social rationales, national cultural identity, intercultural understanding, citizenship development, and social and community development are considered (Knight, 2004). These rationales place more emphasis on understanding foreign languages and cultures, on preserving the national culture, and on respecting diversity through internationalization.

According to Knight (2004), academic rationales focus on the integration of an international dimension into research, teaching and academic standards, institution building, and enhancement of the institution's profile, status, and quality. According to Qiang (2003), there is an assumption that integrating the international dimension into teaching, research, and service enhances the quality of a higher education system. The notion of enhancing the quality of education is linked to the idea that internationalization serves as a positive change for institutional building.

Higher education institutions (HEIs) are giving high importance to branding for a strong international reputation (Knight, 2004). Institutions and companies are competing for the market of recruitment of international fee-paying students, offering for-profit education and programs, selling education services like language testing and accreditation. For branding, institutions strive for accreditation from national and international accreditation bodies. Education providers strive for creating an international reputation and name brand for their own institution to place the institution in a higher position for competitive advantage (Knight, 2004).

To clarify the categories of the five rationales above, Knight (2004) distinguished the rationales between the national and institutional level. At the national level, rationales that drive internationalization in higher education include human resource development, strategic alliances, commercial trade, nation building, and social/structural development, while institutional-level rationales cover international profile and reputation, student and staff development, income generation, strategic alliances, and research and knowledge production (see Knight, 2004).

In her study, Knight (2003) distinguished institutional rationales for internationalization at the institutional level (See Table 1). Here, Knight (2003) listed the rationales by the level of importance and emphasized that the top four rationales relate to the academic rationales while the rest relate more to the economic, political, and social/cultural aspects of internationalization.

Table 1: Rationales for internationalization at the international level

Institutional Level Rationales for Internationalization			
1	Mobility and Exchanges for Students and Teachers	7	International and Intercultural Understanding
2	Teaching and Research Collaboration	8	Promotion and Profile of Institution
3	Academic Standards and Quality	9	Diversify Source of Faculty and Students
4	Research Projects	10	Regional Issues and Integration
5	Co-operation and Development Assistance	11	International Student Recruitment
6	Curriculum Development	12	Diversify Income Generation

Source: Knight (2003)

For this study, it is important to understand the rationales for internationalization as one of the reasons or motivations for internationalization includes the implementation of EMI. Thus, this study will examine the rationales for implementing EMI from the perspectives of staff and faculty members of private universities through an online survey to determine the rationales and policies for adoption of EMI at the institutional level.

English as a Medium of Instruction

IoHE has become a priority for many education systems in many countries where English is not the national language. This is closely connected to the use of English (Yonezawa & Shimmi, 2015). One of the reasons for this is that, as a lingua franca, the use of English represents how non-Anglophone countries try to enter the competitive arena of global higher education and the economic marketplace (Stigger, 2018, p.4). As Coleman (2006) claimed, the reasons for the HEIs to introduce programs and courses taught through EMI are split into seven categories: content and language integrated learning, internationalization, student exchanges, teaching and research materials, staff mobility, graduate employability, and the market for international students. In other words, foreign language learning in itself is not the reason why institutions adopt EMI.

EMI is one trend in IoHE across many non-Anglophone countries as countries shift from their focus from teaching English to teaching academic subjects in English (Graddol, 1997; Dearden, 2014). EMI is defined as “The use of the English language to teach academic subjects in countries or jurisdictions where the first language of the majority of the population is not English” (Dearden, 2015; p.2). EMI is a growing global phenomenon in all phases of higher education, and more and more universities are in a rush to offer both graduate and undergraduate programs through EMI (Macaro et al., 2018). By offering courses in English, an institution is able to attract international students and faculty members, and this brings opportunities for its own students and teachers to participate in international scientific research (Graddol, 1997).

Higher Education System in Mongolia

Before reviewing the process of IoHE and the concept of EMI, it is important to understand the higher education system of the country. Thus, a brief introduction to the higher education system in Mongolia is provided.

Mongolia is a landlocked country with 1.5 million square kilometers of land area, a total population of 3.1 million and a gross domestic product per capita of \$7,800 as of 2016 (Mongolian Statistical Information Service, 2016). The total number of students studying at tertiary school amounted to 157,138 (58% female) in the academic year of 2016-2017. As of 2017, 95 HEIs, including a high percentage of private institutions (78%), national (18%), and a small percentage of branch schools of foreign universities (4%), are operating in Mongolia (Ministry of Education, Culture, Sciences, and Sports, 2017a). The branch schools of foreign universities include three from the Russian Federation and one from Singapore.

The history of Mongolian higher education is rooted in the National University of Mongolia, which was established in 1942 with three faculties: medical, pedagogical, and veterinary (Gantsog & Altantsetseg, 2003). Since then, several faculties were developed: physics, mathematics, natural sciences, social sciences, economics, law, and languages and literature. After Mongolia transferred to a free market economy system in the 1990s, the government ceased most of its funding for national universities, only covering utility costs. This resulted in the introduction of a student fee structure in 1993 (Gantsog & Altantsetseg, 2003). Moreover, the government of Mongolia made a policy of “cost sharing” to shift a greater portion of the burden of payment to individuals and transfer public expenditure on education to student loans. The government also legalized the establishment of private universities and branch schools of foreign HEIs.

Literature Review

The literature review explores the process of IoHE at both national and institutional levels and the concept of EMI in Mongolia.

Internationalization of Higher Education

Despite a handful of studies that discussed the early internationalization initiatives in Mongolia, little is known of current strategies and activities towards internationalization at national and institutional levels. Previous studies focused on the impact of globalization on higher education (Gantsog & Altantsetseg, 2003; Sodnomtseren, 2006), educational expansion in higher education (Agvaantseren & Hoon, 2013), or a strategy for internationalization in one national institution (Jargalmaa, 2015).

At the national level, the Mongolian Sustainable Development Vision 2030, enacted by the Mongolian Parliament in 2016, set an ambitious goal to have at least four Mongolian national universities recognized internationally for research in STEM fields. It indicated,

Build a science and technology cluster and park in accordance with priority development areas, and ensure that no less than four Mongolian universities are ranked among Asian top universities (Partnership for Action on Green Economy, 2017, p.28).

Although there is no assessment information of Mongolian HEIs in the popular ranking systems, such as Times Higher Education’s World University Rankings, Academic Ranking of World Universities, and QS World University Rankings, Mongolian national universities are focusing more on research and publications. As Hu (2017) reports, the proportion of online scientific papers from Mongolia reached 315 in 2016 but dropped to 252 in 2017. This shows that the number of papers produced per year remains low and there is much to do to produce more papers. Hence, two measures are urgent. The government needs to add more

budget for research and development, and national universities should offer more reward to prominent faculties and researchers.

Mongolian HEIs are also changing their fundamental missions, hoping to become international universities. According to Altbach, Reisberg, and Rumbley (2009), at the institutional level, a large number of universities around the world aim to produce “global citizens” with “global competencies” by adopting extended missions under internationalization. Mission statements of a number of Mongolian HEIs highlighted that they aim to become “global”, that is, an internationally recognized university. Table 2 compares excerpts of mission statements from several major national and private HEIs that aim to become research-oriented and leading institutions in Asia and the world.

Table 2: Comparison of HEIs mission statements

	Type	Name	Excerpt from Mission Statements
1	National	National University of Mongolia	“...to become a national model research university which meets <i>world standards</i> * and provides pillars for Mongolia’s development.”
2	National	National University of Medical Sciences	“...to become a national leading and <i>one of top 100 medical universities</i> * in the west coastal area of the Pacific Ocean.”
3	National	National University of Life Sciences	“...to become a leading global university*...”
4	National	Mongolian University of Science and Technology	“...to become <i>one of Asia’s top universities</i> *.”
5	National	National University of Education	“...to become a <i>competitive institution</i> * among Asian universities of education.”
6	Private	Ikh Zasag International University	“...be a modern <i>global university</i> * of technology and innovation.”
7	Private	University of the Humanities	“...to become a reputable and <i>leading university in Asia</i> *...”
8	Private	University of Finance and Economics	“...to become a <i>leading research university</i> * recognized in the region...”
9	Private	Otgontenger University	“...to become a research university that satisfies international standards...”
10	Private	Mongolia International University	“...to educate and develop leaders in Mongolia and <i>throughout Central Asia</i> *...”
11	Private	Mongolian Royal Academy	“...to be a university that provides <i>world-class education</i> *...”
12	Private	Mongolian National University	“...to become a university that leads in Mongolia, <i>Asia, and Europe through research and teaching</i> *.”

Source: Websites of each institution (translated by the author) *Emphasis is made by the author

Mission statements show that becoming recognized in the region, improving research, technology, and innovation, and integrating into international standards are the main goals set by these universities.

Within the initiatives and policies of IoHE, the government of Mongolia, in cooperation with its national universities, strives to build a comprehensive university campus outside the capital city, Ulaanbaatar (Government of Mongolia, 2010a). The goal of the policy is to integrate the national educational system into international dimensions and support the transformation of national and private universities to a campus model. The government of

Mongolia believes that building up a comprehensive campus will lay a solid infrastructure base for adapting the national universities' strategic development goals and improving teaching and research quality. The comprehensive campus development plan will also allow the integration of educational resources among the national universities. In addition, national universities will be able to share resources, develop interdisciplinary research, and pursue a coordinated external relations strategy.

With the goal to improve the quality of higher education through internationalization, the government merged national universities from 42 to 16 in 2010 (Government of Mongolia, 2010b). The private HEIs also started to merge voluntarily following the government policy. The number of private institutions, which amounted to 129 in 2004, reduced to 79 in 2014 and subsequently to 74 in 2017. Another example is the policy on curriculum. The government passed an order to follow the United Nations Educational, Scientific and Cultural Organization's International Standard Classification of Education. Accordingly, 817 fields of studies were reduced to 181 in 2014 (MES, 2014).

In addition, external assessment and accreditation have become necessary to improve the quality and status of higher education in Mongolia. Currently, 74 universities qualified for national accreditation (Mongolian National Council for Education Accreditation, 2017). The accreditation of HEIs was voluntary-based until 2016 when the government made it mandatory for all types of HEIs to undergo accreditation (Legal Info System, 2017). In recent years, international accreditation started to play an important role in Mongolia. The Accreditation Council for Business Schools and Programs has accredited 13 institutions and is processing 8 more, while the Accreditation Agency for Degree Programs in Engineering, Informatics, Natural Sciences, and Mathematics has accredited several programs at national universities.

English as a Medium of Instruction in Mongolia

The Mongolian education system had the policy to teach only Russian as a foreign language when the country had close ties with the former Soviet Union. During the socialist period, it was mandatory for all students, regardless of their fields, to learn Russian for 3-4 years continuously and take a state examination in Russian. This was changed when the English language department opened at the National University of Mongolia in 1956. In the 1990s, when Mongolia expanded its foreign relations with other countries, it needed more professionals who were able to communicate in English. Therefore, more HEIs started to offer English courses. However, there were not enough English language teachers. In 1990-1995, with the support from United Nations Development Program and Overseas Development Administration-British Overseas Development Agency, a specialized English language institute was founded to retrain hundreds of Russian language teachers as English language teachers (Altan-Od & Khongorzul, 2012).

English is not the second official foreign language in Mongolia. However, the documents on the English language in the past two decades show that English is treated as the second main foreign language of Mongolia. In 1997, the Minister of Enlightenment (Ministry of Enlightenment, 1997) passed an order to teach English as a foreign language from the academic year of 1997-1998 in all levels of education institutions. Later, the order by the MECS (2006) indicated that the main foreign language in bachelor's level programs would be English.

The term, EMI, was first used officially in the Comprehensive National Development Strategy of Mongolia, which was based on the Millennium Development Goals (World Bank, 2008). The strategic objective 2 in Education Development Policy indicates the government will “...provide financial support to high schools, vocational schools, and universities which use English as the medium of instruction” (World Bank, 2008, p. 19). Moreover, this document addressed the importance of English, pointed out the goal of making the English language a major foreign language in Mongolia, and set a goal to have civil servants be competent in English by 2021. Prior to this official document, in its resolution on English language education, the government of Mongolia (2001) announced the need to teach EMI courses such as international relations, economics, journalism, tourism, medicine, and technology. The National Program on English Education (Government of Mongolia, 2008) highlighted the importance of “creat[ing] a system/mechanism pushing the need and use of English as the main tool for education, for communication, information access, and business...” (p.5).

Despite a handful of private universities, opportunities to earn academic degrees in English are limited. Examples include the Mongolia International University that has offered undergraduate degree programs entirely in English since its establishment in 2002. Another institution is the Royal International University, which opened its doors offering business degree programs entirely in English in 2010. At the graduate level, opportunities to gain degrees in English are available in joint and dual degree programs (mostly Master’s degree) at major national and private universities.

Based on the literature review, this study explores the driving factors of internationalization. In addition, rationales of EMI in HEIs are discovered through an online survey for faculty members at two private universities. Therefore, the study attempts to answer two research questions before the discussion and conclusion:

1. What are the driving factors of Mongolian higher education institutions to pursue internationalization?
2. What are the rationales of Mongolian universities to adopt policies for English as a Medium of Instruction?

Methodology

The study draws on Knight’s (2004) model of IoHE, “internationalization abroad and internationalization at home” and Soderqvist’s (2000) concept of internationalization as a pathway to increase quality and competencies of higher education institutions as an overarching framework to explore IoHE in Mongolia. All data related to Mongolian higher education, reforms, internationalization policy, and English language policy went through the qualitative document analysis, “describing, classifying and connecting” (Coffey and Atkinson, 1996; p.8) to portray a comprehensive picture of the IoHE and the concept of EMI in Mongolia.

Document Analysis

Following the qualitative document analysis methods (Coffey and Atkinson, 1996), an array of documents was collected from public and academic sources. The collected documents covered policy documents related to Mongolian higher education since the 1990s, including:

- higher education laws, government orders, amendments, and legislation;

- websites of 10 national universities and 18 private institutions (as of 2017);
- official reports by the World Bank, Asian Development Bank, and Open Society Institute;
- selected online newspaper articles at three main newspapers (Daily News, Unuudur, and Zuunii Medee);
- articles written in both Mongolian and English.

Most documents were available in Mongolian, which was not an issue as the author of this paper was born in Mongolia. In addition, the researcher used his insider perspectives working in the higher education sector in Mongolia in the last 14 years. However, it should be noted that the collected documents lacked recent studies and articles related to the topic in this study.

First, the collected documents were read closely to apply topic codes. These topic codes described the main segments of the documents. During the qualitative document analysis, the emphasis was given to official evidence relating to the strategies and approaches for internationalization and EMI policy at the national level. After completing the initial coding process, the coded data were reviewed again and coded segments that reflected similar concepts were grouped into larger categories. After all coded data had been categorized, the categories were reexamined to identify major themes in a relationship with the IoHE in the Mongolian context and the questions of the study. As a result, six dimensions were identified, three of which are presented in this report due to their coverage.

Documents from 28 national and private universities were collected to understand their EMI policies and the implication of EMI in their strategic plans, mission statements, and public identity. It should be noted that there is little available data on EMI in Mongolia. The author has estimated that there are about 385 courses taught in English, identified through his private contacts with the 28 universities' academic affairs offices. However, it was not possible to identify the exact number of degree programs and courses in English in the Mongolian HEIs. The reasons include unresponsiveness when reaching out to the universities' academic affairs offices and inaccessibility of information from the university websites.

Online Survey

Based on documentary evidence, an online survey was conducted with faculty members who teach EMI courses at two leading private universities in Mongolia. The survey was developed based on the objectives and the related literature, and the survey was conducted at the two universities in Ulaanbaatar, the capital of Mongolia. Purposive sampling (Patton, 2002) was used to select these universities. As Patton (1990) emphasized, purposeful sampling lies in selecting information-rich cases for study in depth. From the information-rich cases, one can learn a great deal about issues of central importance to the purpose of the research. From the 17 strategies for purposefully selecting information-rich cases by Patton (1990), the third strategy, maximum variation sampling was used to select the two universities for the survey. This strategy aims at capturing and describing the central theme or principal outcomes that cut across a great deal of participants or program variation. Moreover, document analysis revealed that these two universities have more EMI degree programs than other private universities. National universities were excluded due to this reason.

The survey aimed to analyze the rationales for adopting the EMI policy and examine its implementation in two private universities. To provide rich data about the implementation of EMI, the survey targeted the two private universities that EMI earlier and have implemented

it most aggressively among Mongolian HEIs. The survey was originally distributed to 25 faculty members in University A and 30 faculty members in University B. Twenty faculty members from each university who are teaching EMI courses participated in the survey (see Table 3).

Table 3: Demographic characteristics of the respondents

Characteristics	Number
Faculty members qualification	40
Doctoral degree	8
Doctoral candidates	11
Master's Degree	21
Teaching experience	
Below 3 years	12
Above 3 years	6
5 years and more	6
10 years and more	16

The survey had 18 questions: five questions on respondents' personal information such as history/experience of teaching courses in English, the experience of teaching overseas, seven yes-no and multiple-choice questions; four five-level Likert-scale; and two open-ended questions. The online questionnaires that were designed in English in the google forms were sent to the faculty members in January 2018. The questionnaire was closed in February 2018. The gender of the survey respondents was 25 females and 15 males. The majority of the respondents' nationality was Mongolian (24 faculty members) while the rest were American (5), Bangladeshi (2), Korean (7), and Chinese (2). To ensure that respondents in the survey provided honest answers, the survey was conducted anonymously and it did not request names and other private information that may reveal their identities.

Data Results

Main Dimensions of Internationalization

The document analysis identified six main dimensions of the internationalization process at HEIs: (1) Administrative leadership and structure; (2) Faculty development; (3) Internationalized curriculum development; (4) Student mobility; (5) Distance Education' and (6) International partnership and collaboration. This section explores three dimensions (2, 4, and 6) in the internationalization processes of Mongolian HEIs in global and local contexts, their actions and strategies, and underlying motivations.

Faculty Development

The role of faculty members is vital in the institutional internationalization process. Hiring new faculty members or re-training existing faculty members is central to the success of approaches to internationalization and maintenance of quality standards. The Mongolian government action plan of 2008-2012 (Legal Info System, 2018, p. 5) indicated in the section under education, "...faculty development program will be implemented in HEIs", and "...Young researchers and scholars will be supported" in order to improve higher education quality. In addition, the Roadmap for Higher Education Reform sets goals for faculty development for 2010-2021 to increase the number of higher education faculty members with a PhD by at least 50 per cent (MECSS, 2017b). Currently, 2034 of 6917 (29%) full-time faculty members have a PhD (MECSS, 2017a).

Since the 1990s, faculties in HEIs had scarce opportunities and resources to develop their skills and knowledge. Although international philanthropic organizations such as the Open Society Institute offered short-term exchange programs for faculties across all HEIs, faculties still lacked language skills to benefit from international training. However, this is changing and national universities are now focusing more on faculty development in order to increase their quality and visibility.

According to the categories of faculty development developed by Fink (2013, p. 2), Mongolia belongs to the first level of faculty development, “little or no faculty development activity”. Main national universities are striving to offer more faculty development opportunities, thus, aiming for the second level, and “a substantial minority of institutions offering faculty development activity where participation is voluntary” Fink (2013, p. 2).

Despite these initiatives, the majority of HEIs still do not have a comprehensive plan for faculty development and faculty members spend little time for self-development due to a heavy workload (Narankhuu & Batkhishig, 2015). As Itgel, Oyungoo, Sumyasuren & Otgon-Erdene, (2018) concluded in their study, most of the faculty members (67%) at national universities viewed developing academic research and foreign language skills as the top priority in faculty development. This means that faculty members feel disadvantaged in participating in and conducting high-quality academic research in a foreign language, mainly in English.

Student Mobility

Mongolia hosted 1,520 inbound international students in 2017 (MECSS, 2017a). Of these, 56% were studying at the bachelor's level, 33% at the master's level and 11% at the PhD level. The geographical origin of incoming students reveals that the largest number of students are from China (969), Russia (182), and South Korea (132), representing 84% of all international students. Compared to the last five years, the number of international students increased by 0.7% (It was 1,098 in 2012) (MECSS, 2017a). In addition, the “EBI” government-funded short-term scholarship (initiated by the former President Elbegdorj in 2017) encourages inbound student mobility. The purpose of the program is to support foreign young researchers and scholars conducting research in Mongolian studies. Currently, nine researchers from eight countries received this scholarship in 2017 (Ministry of Foreign Affairs, 2017).

In regards to outgoing mobility, the government of Mongolia promotes study abroad programs with the aim to prepare domestic students for international careers and develop future high-level human resources. In 2014, the government commenced the Higher Engineering Education Development Project in cooperation with the Japan International Cooperation Agency to prepare 1,000 Mongolian engineering students in Japan by 2023. Currently, 400 students, faculty members, and researchers have received the scholarship (Munkhtulga, 2018). Between 1997 and 2017, 2,076 students received Mongolian government and intergovernmental scholarships.

The number of outbound Mongolian students has been stable during the past decade, with only some minor fluctuations. The most popular destination countries included the United States of America, China, Russia, Japan, Korea, and Taiwan. Numerous foreign government-funded scholarships have a great impact on the outbound mobility of Mongolian students.

The popular scholarships are from the United States of America, Japan, China, the United Kingdom, Australia, Russia, Germany, Hungary, and South Korea.

International Partnership and Collaboration

For HEIs worldwide, building relationships with counterparts abroad is seen as a key aspect of strategies for internationalization. A great number of HEIs around the world are eager to establish joint and dual degree programs and other types of partnerships with foreign institutions (especially in highly developed countries).

With regard to internationalization abroad, Mongolian HEIs experience international partnership and collaboration in two ways: joint/dual degree programs including student exchanges and research and academic collaboration. The foreign partner schools in Asia, especially from Japan, South Korea, China, and Taiwan weigh higher than other regions. Examples show that 146 of 220 foreign partners with National University of Mongolia are from Asia, 83 of 137 at Mongolian University of Science and Technology, 47 of 70 at National University of Education and the list goes on. Student exchange programs are funded by an array of institutions from private companies (e.g. Mitsubishi Scholarship) and national institutions (e.g. Mongolia-Namyangju Education Promotion Scholarship) to the government (e.g. Erasmus Mundus program).

Dual degree programs have become attractive for students interested in getting an international degree but have limited resources to complete full four years abroad. Thus, institutions offer such programs to attract more students, which require increased English language exposure, training, and quality in order to prepare students for partner institutions.

In Mongolia, joint and dual degree programs mostly in business studies have been experiencing considerable growth over the past decade. About 40 joint/dual degree programs were offered at national universities as of 2017. Most of the programs are taught in English; thus, it requires students to have advanced English skills. The tuition fee for these programs is much higher, compared to the domestic average.

Research and academic collaboration is an excellent way to not only accelerate the internationalization progress, but also enhance the institutional quality and improve the performance of partners. HEIs in Mongolia benefit from participating in effective research and academic collaborations with others, both within and outside the country. In 1974-2016, the government of Mongolia funded 4235 research projects (23.5% in natural science, 23.5% in technology, 22.8% in medical science, 17.8% in social science, and 12.4% in agricultural science) (MFST, 2016). However, joint projects make up a small percentage – 18% in social science, 12% in natural science, 2% in medical science, 2% in the agriculture, and 2% in technology. In 2016, \$3.1 million was allotted to HEIs for 164 research projects (MFST, 2016). Unfortunately, Mongolian HEIs have not yet released any accurate data regarding their academic collaboration with foreign institutions.

Online Survey

The main aim of the survey was to analyze the EMI practice in two private universities and to investigate internal and external factors that influence the adoption of EMI policy at the institutional level from the perspectives of faculty members. This survey involved two institutions that started offering EMI courses earlier, in a more extensive way, and implementing EMI more aggressively than other Mongolian universities (see Table 4).

To interpret the survey results, I explored documents related to EMI courses and programs, including materials from each university's website. The survey asked faculty members about their students, internal and external factors for implementing EMI practice at their university, challenges, and recommendations and suggestions for the improvement and efficacy of EMI courses.

Table 4: Profile of the universities

Basic information	University A	University B
Type of institution	Private	Private
Approx. # of undergraduate students	4000	1000
Approx. total # of international undergraduate students	70	150
# of undergraduate EMI	12 (programs)	13 (programs)

What are the internal and external factors for implementing EMI programs? This section explored the internal and external factors for implementing EMI courses at the two universities (see Table 5). The participants were asked to rank the three most important internal and external factors. In regards to internal factors, the majority of the universities' faculty members perceive that EMI programs are offered in order to improve their students' English proficiency and to prepare global citizens. This idea is connected to the notion of preparing global leaders who can be actively engaged in international activities through English. Faculties at University A ranked "Increase the ranking of the university" as one of the main factors driving EMI policy while University B chose "Create an international environment for the students".

Table 5: Comparison of internal and external factors

	University A	University B
Internal Factors	Improve English skills of domestic students (20)*	Improve English skills of domestic students (20)*
	Prepare global citizens (18)*	Create an international environment for students (20)*
	Increase the ranking of the university (18)*	Prepare global citizens (20)*
External Factors	Student exchange programs (20)*	Student exchange programs (20)*
	International collaborations (20)*	International collaborations (20)*
	Domestic university ranking (18)*	Domestic university ranking (20)*

* Number of faculty members agreed

As for external factors, all respondents from both University A and University B believe that student exchange programs and international collaborations are the primary reasons for their universities to implement EMI courses. This pattern confirms the result of the document analysis that University A is actively engaged in international collaboration with foreign partner universities through various exchange degree programs. For University B, it seems the student exchange programs and international collaborations play a crucial role in the implementation of EMI. In Mongolia, most of the student exchange programs in HEIs are run in English, hence EMI is seen as one of the external factors in the development of student exchange programs at these universities through international collaboration. Interestingly, the

answers of the respondents of the two universities display that their universities place much emphasis on English education to raise their domestic university ranking, which is the third factor for implementing EMI.

Challenges. It is clear that there are many challenges that hinder successful implementation of EMI. To gain a better understanding of these challenges, respondents were asked to choose the four most important challenges from the following key challenges.

- Student dissatisfaction;
- Limited English proficiency of students;
- Outside pressure;
- Structural challenge;
- Cultural challenge;
- Increase in workload;
- Linguistic difficulties;
- Intercultural problems.

Table 6 presents the list of challenges by the level of importance as determined by the number of respondents who ranked the challenges as most important.

Table 6: Comparison of challenges

University A	University B
Increase in workload (16)*	Linguistic difficulties (14)*
Outside pressure (16)*	Structural challenge (14)*
Structural challenge (14)*	Cultural challenge (14)*
Linguistic difficulties (14)*	Limited English proficiency of students (14)*

*Number of agreed respondents

The challenges that the faculty members from these universities selected are similar to results that have been found by many researchers (see Airey, Lauridsen, Räsänen, Salö, & Schwack, 2015; Chapple 2015; He & Chiang, 2016; Doiz, Lasagabaster & Sierra, 2011; and Galloway, Kriukow, & Numajiri, 2017).

Recommendations and Suggestions

The survey had two open-ended questions. The purpose was to find out more about faculty experiences in EMI followed by a request to give their recommendations for those who are going to teach EMI courses, and universities that are planning to offer EMI courses. The answers showed that University A's faculty members focused more on the preparation of classes, pedagogical training, and language issues while University B's faculty members gave more emphasis on collaborative ties between departments, and practical advice of what changes and challenges to expect.

In terms of recommendations for universities, University A's faculty members advised that a university planning to offer EMI courses should provide their teachers with pedagogical training, course materials, and a good working environment. University B's faculty members recommended pedagogical training for faculty members, preparation of quality curriculums, and emphasis on English language proficiency of prospective students. It seems that

pedagogical training or a workshop is important to the faculty members in order to work successfully in the EMI context and as well as the curricula along with course materials.

Discussion and Conclusion

This study attempted to explore the IoHE in Mongolia, current strategies and approaches to internationalization at the national and institutional levels, the concept of EMI policy and its implementation in HEIs in Mongolia. This study addressed two research questions:

1. What are the driving factors for Mongolian higher education institutions to pursue internationalization?
2. What are the rationales of Mongolian universities to adopt policies for English as a Medium of Instruction?

In terms of the first question, the key findings of this research show that at the national level, the world university ranking causes the government to push its national universities to pursue internationalization. In the bigger picture, the Mongolian government perceives the IoHE as a way to integrate international dimensions into higher education (Knight, 2003) in order to improve the quality of higher education (Soderqvist, 2002). These two reasons are the key drivers of internationalization.

At the institutional level, national universities put a greater emphasis on rankings, research output to journals with high impact factor, international collaboration and delivery of courses in English. On the other hand, private institutions are increasingly applying for international accreditations to compete for high-tuition paying domestic students. These two phenomena are moving the IoHE in Mongolia forward by integrating international dimensions into higher education.

Although the government of Mongolia makes progress through strategic actions and projects in the higher education sector, Mongolia's internationalization efforts are still dispersed and managed in an ad-hoc fashion. At the national level, higher education policies and laws are not stable and they are constantly changed. Consequently, the internationalization process is becoming slow. As expected in the Roadmap for Higher Education Reform 2010-2021 (MECS, 2010), Mongolia's first ambitious priority is to have four universities to be internationally visible at least in Asia by 2021. However, the plan is way behind the schedule. The Mongolian government should consider actions to intensify faculty development on a substantial scale for the development of scientific research in the country. The government should also grant full autonomy to national universities and increase its investment in the coordination of international initiatives. The document analysis of the discourse of IoHE in Mongolia presented the following key challenges:

- Institutional autonomy and short-term leadership. When the government of Mongolia appoints rectors for limited terms, national universities face difficulties with autonomy and short-term leadership to maintain the continuity of vision for internationalization and sustaining strategic actions over extended periods.
- Insufficient funding. Funding and grants are unstable and insufficient for the internationalization process to go forward. This surely relies on the country's economic capacity and it will likely have long-term consequences for Mongolia's internationalization agenda and outcomes.

- Quality assurance. Before 2016, HEIs were not required to go for accreditation. The only incentive for it was the government's financial support in the form of student loans only to accredited HEIs. The negative results of not being accredited may include a loss of funding, students, and even bankruptcy. Now there is a hope that the mandatory accreditation will benefit all HEIs and their stakeholders.

The Mongolian government is the key player in IoHE by making policies, taking initiatives, and encouraging national universities. However, the process of internationalization is much slower in private HEIs. More in-depth research and particularly qualitative research of a comparative nature are clearly needed in order to gain greater insights into how the IoHE is implemented at national and institutional levels.

In terms of the second research question, it is clear that more private rather than national institutions utilize the forms of international delivery through joint and dual degree programs as Deschamps and Lee (2015) claimed. The forms of joint and dual degree programs in Mongolia support Mongolian domestic students to study abroad rather than calling for international students. The medium of instruction in the courses offered in the joint and dual degree programs is mainly English. The country will remain disadvantaged if the number of programs in English is not leveraged because this is crucial to many aspects of internationalization. While many foreign institutions implement EMI to attract international students, this does not seem to be a practice at Mongolian HEIs.

As Macaro et al. (2018) concluded, the rationales for adopting EMI in a broader global context include:

1. a perceived need to internationalize the university;
2. the need to attract foreign students due to the decreasing number of domestic students;
3. national cuts in HE investment;
4. the need for national HEIs to compete with private ones; and
5. the importance of English in academic research publications.

By comparison, in terms of the second research question, in the Mongolian context, the document analysis identified that HEIs in Mongolia implement EMI for the following four reasons:

1. increasing the employability of domestic graduates;
2. promoting international collaboration;
3. generating more income; and
4. increasing domestic and international profile.

These four reasons are interrelated. When national universities strive to increase their international profile by offering EMI courses and joint/dual degree programs in English, private universities promote international collaboration via joint and dual degree EMI programs to generate more income. Both national and private universities pay much attention to the employment ratio of their graduates due to the increasing demands of international and domestic business organizations to hire graduates who will be able to work internationally. English language knowledge is one of the main requirements for employment. To some extent, the survey findings show similar results as the document analysis identified. The faculty members of the two leading private institutions perceived that the introduction of EMI at their universities intends to improve their graduates' English language skills to operate

globally as well as to sharpen their university's international profile. As noted, this survey was conducted for the first time in the Mongolian context.

Due to time constraints, a more in-depth study including interviews with the faculty members and administrators of EMI programs should be done to have a more complete view of the EMI in Mongolia. In addition, a comparison of data from more private universities would have been valuable.

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Transfer of Learning and Teaching: A Review of Transfer Theories and Effective Instructional Practices

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Abstract

One of the primary goals of education is to ensure that learners can apply their acquired knowledge in various ways and under different circumstances. However, this expected “transfer” does not always occur and, therefore, the acquired knowledge cannot be flexibly employed in different contexts. One way to minimize this problem is to understand how transfer occurs and what learning conditions can improve this process. This review paper provides major theoretical perspectives and pedagogical practices to explore the most effective ways to optimize knowledge acquisition and transfer. The results of the comparison of the selected theories indicated that transfer was a multi-dimensional process that could occur at any stage of learning and could be enhanced through coaching, scaffolding, interacting, assessing and reflecting in situated learning environments.

Keywords: transfer of learning and teaching, situated learning

Many researchers have defined transfer as the productive application of prior learning and experiences in novel contexts (Gass & Selinker, 1983; Gick & Holyoak, 1987; Roediger, 2007). While the definition of a “novel context” may initially appear ambiguous, most transfer studies consider a novel context as a situation that is potentially different from the original situation in which learning has already taken place (McDaniel, 2007). Thus, applying knowledge to a different domain, aligning it with a new goal and being assessed differently, can all be considered as novel contexts (Barnett & Ceci, 2002; Pan & Richard, 2018).

A large body of research indicates that students often find transferring knowledge to situations other than the one in which it was learned highly challenging (Gilbert et al., 2011). Therefore, many educators and researchers have attempted to identify the factors that influence later acquisition of knowledge by examining the cognitive and metacognitive processes that occur during the learning process. The result has been a vast amount of literature with various perspectives towards learning and instructional practices along with large variability among findings (Blume, Ford, Baldwin, & Huang, 2010). Therefore, the goal of this article is to review some of these theories to identify the consistent factors that facilitate knowledge transfer and provide examples of the instructional strategies that can provide optimal opportunities for learners to apply their acquired knowledge and expertise.

Since discussing all theories from transfer literature is beyond the scope of this review, only a few traditional and contemporary theoretical perspectives will be provided and discussed. These theories begin with the traditional cognitive theories of transfer and end with more contemporary learning transfer theories. However, the selected instructional practices will predominantly be based on social constructivist approaches to learning such as situated learning theory. The reason for this choice is the extensive employment of contextual and inquiry learning methods in science and technology research and the presence of empirical evidence for successful application of these methods (Aparicio-Ting, Slater, & Kurz, 2019; Potvin, Hasni, & Sye, 2017). At the end, some of the advantages and disadvantages of the stated theories will be discussed and several pedagogical suggestions will be provided.

Theoretical Models of Transfer

Theory of Identical Elements

Learning transfer has become a significant research topic in educational psychology since Thorndike and Woodworth developed the theory of *identical elements* in 1901 (Schunk, 2004; Singley & Anderson, 1989). According to this theory, learning can be transferred from one activity to another (e.g., training to performance) if the two activities are highly similar and share many common elements. The level of transfer is also determined by the level of similarity between the original context of the training and the target context of the performance. Thorndike conducted a study on 8,564 high school students and noticed that the art and science courses taken by the students had very little effect on their problem-solving skills. For example, subjects such as math, physics, chemistry, Latin and French had very little effect on strategic thinking and problem-solving skills. While the challenging practices of learning sciences had helped students develop general learning skills and intellectual abilities, it had not helped them develop efficient problem-solving abilities required to tackle real life problems. He therefore emphasized the significance of the relationship between the content taught in school and the demands of real-life skills. Identical elements theory challenged the traditional view of teacher-centered pedagogy and became one of the pioneers of active learning theories. This view of learning was followed by Dewey's pragmatic view of learning and his idea of inquiry learning classrooms. According to this

view, classrooms need to represent real life situations and provide opportunities for students to flexibly participate in distinct learning activities and in distinct social contexts (Dewey, 1938; Gutek, 2014; Williams, 2017).

Theory of Low and High Road Transfer

In 1989, Perkins and Salomon developed the integrative theory of “low and high road transfer”. According to this theory, there are two different, but connected, underlying mechanisms for transfer, namely, low road and high road. Low road transfer usually occurs when the target and original activities share a countless number of features. For example, a person who is driving a small truck for the first time usually finds the experience very similar to the experience of driving a sedan car. Driving the truck is the same habitual experience although it seems like a different task (Perkins & Salomon, 1989; Perkins & Salomon, 1992). These reflexive behaviours or automatic responses in similar activities are the result of countless hours of practice. However, high road transfer occurs as a result of mindful abstraction of general principles among different events in different contexts and a deliberate search for connections among their structures. For example, a person who takes a C++ programming course and is assigned a game development project at the end of the semester needs to ensure that he or she knows the programming language well and then deliberately search for the connections between what has been learned and what needs to be designed in a novel context. Similarly, learning Newton’s Laws in a Physics course and applying them to building an aircraft model needs flexible adaptations of underlying principles to a completely new environment. High road transfer demands time for exploration, discovery, flexible adaptation of skills, and asking questions such as what the problems are, what principles need to be applied and how the final outcomes need to be assessed. In practice the low and high road theory has offered two ways for learners to increase their chance of applying their knowledge in different situations flexibly: effective practice and mindful abstraction of knowledge (Perkins & Salomon, 1988, 1989, 1992).

This theory leads to two broad instructional strategies in fostering transfer: “hugging and bridging” (Perkins & Salomon, 1992, p.10). Hugging is an instructional strategy that directly guides and engages the learner in the desired target performance and therefore promotes reflexive transfer. For example, a teacher might give students sample exam questions rather than just explaining how some particular strategies may help them succeed in the exam. Similarly, a university job counselor might encourage students to engage in mock interviews rather than just providing them with some general rules of effective job interviews. This way the learning experience hugs the target performance and optimizes the likelihood of automatic performance in similar situations (low road transfer). On the other hand, bridging employs the high road to transfer. This instructional strategy encourages intentional abstraction of the general rules by searching for possible connections among various experiences or examples and applying them to unknown cases. For example, an instructor who prompts students to adopt an exam strategy based on their previous experiences creates an opportunity for students to analyze and reflect on their strengths and weaknesses and create a general strategic plan for their future exams. To maximize high road transfer, instructional designers need to create generic skills that can be used in various situations and not uniquely applicable to their original context (Winn, 1993).

Theory of Analogy and Abstraction

Abstraction is one of the most fundamental principles of many cognitive theories of transfer. As Skemp (1986) defines it, abstraction is “an activity by which we become aware of similarities among our experiences” (p. 21). By identifying the underlying principles of

actions, thoughts, perceptions, and operations we can facilitate the transfer of knowledge to contexts that are fundamentally dissimilar from those that are initially encountered (Gick & Holyoak, 1980; Hayes & Simon, 1977).

There is ample evidence that understanding of the world is based on abstraction rather than superficial comprehension of various systems and their relationships. This is particularly true in understanding and discovery of underlying scientific principles. For example, in a biology course the goal is to understand the genetic laws behind multiple generations of pea plants and not the particular properties of the plants in isolation. Similarly, in physics the goal is to find out the fundamental principles of conservation of energy and not watch what happens to a particular spring when it is weighted down (Chi, Feltovich, & Glaser, 1981). In fact, the progress of science and mathematics is mostly due to the deep conceptual principles shared by the phenomena that may look dissimilar on the surface but which are defined in terms of the same categories or models (Goldstone & Sakamoto, 2003) such as the underlying principles of Golden Ratio in nature or the Fibonacci pattern in reproduction.

One effective mechanism for abstraction is analogy (Gentner & Hoyos, 2017; Hajian, 2018). Although analogical transfer may seem intuitive and natural, it is based on complex mechanisms that need to be employed for extraction of commonalities among various cases and discarding the unrelated information (Gentner, 1983; Gick & Holyoak, 1983; Hummel & Holyoak, 2003). For example, when a person knows how to solve a linear equation with unknown variables added together, it is highly possible that the person also knows how to solve the linear equations with different operations (e.g., subtraction, multiplication, and division) using analogical comparison. Analogy and reasoning can lead to efficient problem-solving strategies which are based on four components of retrieval of information, mapping structures, transferring solutions, and generalization (Gentner, 1997; McFate & Forbus, 2016). Among all these components, it seems that retrieval and access to the source analogue is the most challenging process. And therefore, it can be performed successfully if explicit scaffolding such as hints and cues are provided for finding a suitable source for analogy (Gentner et al., 1994; Holyoak & Koh, 1987; Schmid, Wirth, & Polkehn, 2003). Evidence shows that many university students often fail to employ structurally similar analogies spontaneously (Gick & Holyoak, 1980; Hayes & Simon, 1977) although using this strategy can greatly facilitate the process of creation of new schemas (Gentner & Hoyos, 2017). Given the critical role of structural similarity and mapping in schema formation and successful transfer (Holyoak & Koh, 1987; Reed, 1989; Salomon & Perkins, 1989), it is important to include analogy as a supportive mechanism of instruction and knowledge assimilation (Chi, Slotta, & De Leeuw, 1994). Additionally, analogies can be employed as exploratory and creative tools for solving complex relational problems (Duit, 1991; Glynn, Britton, Semrud-Clikeman, & Muth, 1989). For example, a novice looking at a chessboard in the middle of the game becomes overwhelmed by the huge amount of information required to be processed whereas a chess expert can very quickly recognize the structural similarities among various positions and relations and work with manageable meaningful structural pieces (Chase & Simon, 1973).

Given the power of analogical comparison in knowledge transfer, along with many other robust cognitive mechanisms of transfer, such as self-explanation (Chi et al., 1994; Rittle-Johnson, 2006; VanLehn & Jones, 1992) and test-enhancement strategy (Pan & Richard, 2018; Roediger & Butler, 2011), how can educators incorporate these mechanisms in instruction to promote expert learning? A number of studies addressed this question in the 1980s and indicated that the possible solution was learning in similar contextual

environments. It appeared that from practical point of view “contextual similarity” between various situations plays a higher significant role in determining whether transfer can actually occur (Day & Goldstone, 2011). This view criticized the cognitive learning models employed in schools as decontextualized and individualized pedagogical models that led to independent possession of knowledge by the learner (Wilson & Myers, 2000). The idea that concepts are abstract, self-sufficient, and separate from the context does not support the idea that learning is an active and engaging process (Bonwell & Eison, 1991; Brown et al., 1996). Furthermore, acquiring abstract knowledge does not guarantee transferrable knowledge – this is similar to a situation when a person has quality tools but is unable to use them. The gap created between knowing and doing prevents learners from using their knowledge within an appropriate context (Bransford et al., 2000; Brown, Collins, & Duguid, 1989).

Situated Learning Theory

Although some of the major transfer theories developed simultaneously, it was the theory of “situated learning” (Lave, 1988) that integrated most of the separate branches of investigation into a more complete theory of learning and transfer. In this view, learning and cognition are situated and developed through purposeful authentic activities in social contexts. Therefore, learning and transfer occur when learners are given an opportunity to “observe and practice *in situ*” (Brown et al., 1989, p.34).

This theory is founded on the principle that knowledge is constructed if the learner becomes an active participant of a highly connected community in which knowledge and culture are integrated. Learning should also be an unintentional process rather than a deliberate one – a process that can take place through “legitimate peripheral participation” (Lave & Wenger, 1991).

What Lave (1988) observed in her work with apprentice tailors is a good example of how learning can occur as a social phenomenon and how novices become experts through legitimate peripheral participation (LPP). She noticed that newcomers to the community of professional tailors began their jobs by doing lots of trivial tasks such as running errands, preparing the materials for the tailors and cleaning the workspace. Then, they helped the masters by finishing the details of the clothes and gradually helped them more and more with advanced jobs until they became experts themselves. Lave argues that the trivial looking jobs performed at the initial stage of learning are not trivial at all as they provide an opportunity for novices to familiarize themselves with the fundamental knowledge required for that community. The small responsibilities progressively change to more advanced activities such as cutting, sewing, and designing (Lave & Wenger, 1991). Therefore, it is mostly through participation within a community of practice that learning and transfer can gradually occur. This is similar to the foreign language learning process which is only possible through application of words and grammar “within” society and not just memorization of isolated words from the dictionary. For example, in the study conducted by Preston et al (2015), it was shown how context-aware systems could help learners keep track of their progress during an activity and how this strategy allows them to take language learning to a level beyond the traditional environment of the classroom.

Lave and Wenger define community of practice as members of the same group, with shared interests, goals, and passions participating in a sociocultural practice on the regular basis. Cognition is developed in this type of practice (Chaiklin and Lave, 1996; Lave, 1988) and novices can become experts through moving from peripheral participation to the central role of the community with more expertise (Lave, 1988; Chaiklin & Lave, 1996). The idea of

cognition in practice supports the significance of the instructional cognitive apprenticeship model in learning and transfer of complex skills (Brown et al., 1989). It is important to know that the concept of “participation” does not only refer to informal or unplanned activities. Participation can also be an arranged activity in formal lessons, laboratory experiments, scientific conversations and workshops within the same community (Wenger, 1999).

The role of cognitive apprenticeship in learning has been demonstrated for various skills such as mathematics, reading and writing (Brown et al., 1989), genetics (Charney et al., 2007), chemistry education (Stewart & Lagowski, 2003), learning clinical skills (Wooley & Jarvis, 2007) and web-based problem solving (Kuo, Hwang, Chen, & Chen, 2012). All these studies provide evidence that learners need to immerse themselves in authentic learning environments and gain expertise through participation in the community of practice (Brown et al. 1989; Greeno & Moore, 1993; Herrington and Oliver, 2000; Lave, 1988). For example, in the study conducted by Preston et al (2015), it was shown how context-aware systems could help learners keep track of their progress during an activity and how this strategy allows them to take language learning to a level beyond the traditional environment of the classroom.

Instructional Practices

One of the most efficient ways to assist learners to adapt to the demands of novel situations is to provide them with appropriate knowledge and skills that are necessary to confront and solve complex real-life problems (Brown & Duguid, 1993). One effective practical way to implement this idea is to design a pedagogical environment that can provide an authentic environment and authentic activities so novices can have access to expert performance, scaffolding at critical times, sufficient support for collaborative construction of knowledge, and monitoring within the learning environment (Herrington & Oliver, 1995, 2000).

Although it is difficult to implement a program that integrates all of the above factors, it has been shown that pedagogical models such as problem-based learning (PBL), community of practice (CoP), cognitive apprentice (CA) and game based learning (GBL) can integrate many components of the situated learning theories such as collaboration, coaching, practice, problem solving and reflection. There is ample evidence that these models can be implemented successfully in educational practices and make significant changes in student learning and transfer abilities.

Problem Based Learning (PBL)

PBL is founded on four principles of “constructive, self-directed, collaborative and contextual learning” (Dolmans, De Grave, Wolhagen, & Van Der Vleuten, 2005, p.732). In PBL both learning and teaching are problem driven. The ill-structure problems used in PBL allow learners to create connections between theory and practice to develop the required ability to handle complex challenges of real-life situations (Hung, 2013; Savery, 2015).

Reflection is one of the most critical components of PBL as learners constantly need to monitor their conceptual and procedural understanding for effective learning and adaptive problem-solving strategies. This monitoring process allows refinement of knowledge and supports learners in discovering the underlying structural relations between concepts and categories (Hung, Jonassen, & Liu, 2008; Jonassen & Hung, 2012). Self-directed learning (SDL) is another crucial component of PBL that is fundamental to the development of far transfer ability. SDL requires reasoning skills and analytical approach towards the issues that

arise in the process of learning and application. These skills allow the learner to develop cognitive flexibility and decision-making ability required for tackling unanticipated novel problems (Nerali, Telang, Telang, & Chakravarthy, 2016; Stolper et al., 2011). PBL has successfully been implemented in many science courses such as physics (Celik, Onder, & Silay, 2011), mathematics (Ronis, 2007) and medical education (Barrows, 2000).

Communities of Practice (CoP)

Communities of practice are shaped by individuals who have highly similar concerns or interests and are willing to encounter challenges related to their shared interests or concerns through collaboration and interaction together. What makes a community of practice productive and functional is an effective leadership. A leader (coach or tutor) facilitates collaboration and fosters participation during the process of learning (Schwarz, 2002). For example, in the community of practice of the classroom, the teacher takes a leadership position by facilitating the actions and decisions of a group of students (Shields, 2003; Wenger, 2000). This collaboration can also occur in a virtual context such as a multiuser online discussion board or a virtual lab. Although the physical presence is missing in these environments, communities of practice can still be formed in a highly dynamic manner. A good example of promoting CoP in an online classroom is assigning group projects that can be performed in collaborative documents such as Google Docs. Using online sharing document software, learners can discuss their ideas in real-time, evaluate their work together, edit the document as a team and generate new goals and ideas for their future collaborative projects. In fact, virtual environments may contain a variety of unique features that cannot be found in physical CoP environments.

Cognitive Apprenticeship (CA)

Cognitive apprenticeship is strongly based on “modeling, coaching, and fading” (Brown et al., 1989, p.39). An expert coach (e.g., a professor) begins to promote learning through making his or her tacit knowledge explicit and model the required strategies in an authentic activity for students (Brown et al., 1989). Students use the provided knowledge, manipulate it and discover their own way of managing knowledge. For example, graduate students learn how to do proper research by working on an authentic research project with their supervisors as opposed to learning the principles of research from the books and practicing the learned principles at the library. The supervisor monitors the resources used by the students, guides them through the process of research and provides them with the opportunities they need to tackle authentic complex research problems. The professor also provides coaching and scaffolding along the way if required. In fact, monitoring and providing feedback are highly pivotal to this process. Unlike the traditional apprenticeship system that is only focused on concrete physical skills, cognitive apprenticeship emphasizes on all the cognitive and metacognitive processes that are involved to achieve mastery of the field. As Brown et al. (1989) argue this model is founded on “learning-through-guided-experience on cognitive and metacognitive skills and processes” (p. 457).

Many studies have provided evidence on the role of this model in improving student learning transfer in different areas. For example, in the study conducted by Wedelin and Adawi (2014), in a mathematical modelling course, those who worked with supervision in a cognitive apprenticeship environment (e.g., in pairs of an expert and a novice) demonstrated significant changes in their mathematical thinking and modeling in real work projects. The students also considered the course as one of the most productive and creative courses taken in their entire program.

Similarly, in another experiment conducted by Chiu, Chou, and Liu (2002), the results indicated that grade 10 students who learned chemical equilibrium in a cognitive apprenticeship context gained better understanding of this phenomenon compared to the control group. They also managed to solve more challenging problems than the control group.

Teaching in a cognitive apprenticeship environment is highly successful in preparing students for confronting complex problems in the workplace or any authentic context as this instructional practice is based on modeling, coaching, scaffolding, discovery, articulation, and reflection (Schoenfeld, 1985). Therefore, the implementation of this educational model is highly recommended in promoting learning transfer and problem solving in science and engineering. One of the challenges of implementing this model is the requirement of a small teacher to learner ratio, which may not be possible in large classes or groups.

Game Based Learning (GBL) and Simulations

Educational games and simulations can also provide pedagogical contexts in which learning can effectively take place under particular pedagogical conditions (Clark, Tanner-Smith, & Killingsworth, 2016). These interactive environments allow learners to check their understanding of the real-world phenomena through observing, modelling, comparing, testing, and reasoning. For example, simulations can provide immersive model-based environments that allow learners to simplify or challenge the concepts or the principles they are learning (e.g., the principle of conservation energy or principles of chemical equilibrium) and expose themselves to various dimensions of the learned principles (e.g., the multiple ways a formula or a concept can be applied). Additionally, the embedded features of the simulation allow repetitive practice along with real-time feedback on the user's learning progress in the environment (Dede, 2012). For instance, the immersive game of Spore ("Spore™", 2018) provides an opportunity for learners to repeatedly design creatures that can transform through numerous stages of evolution and develop into new varieties. Despite some scientific imprecision, players can directly observe their creatures and their effects on the ecosystem. This interaction with the system allows players to constantly apply what they have learned about evolution and continuously modify their designs to ensure what has been learned is valid and applicable.

SimCity™ ("Electronic Arts", 2018) is another simulation that has been used for engaging learners to build cities that can continuously evolve. Interestingly, this simulation shows the user how the choices they make in the game can have dramatic consequences on the life of people, businesses, and natural resources. Incorporating such simulations in the curriculum provides a great opportunity for students to assess the functionality of their constructed cities in comparison to the similar designs in the real world. It also allows them to analyze the effects of their construction on the health of the ecosystem, environment, economy, the future of agriculture, and many other challenges of today's modern world. In fact, in the recent study conducted in an urban geography course, the university students who used SimCity to construct their own cities had a greater opportunity to apply the theories they had learned to support their urban structures. They also needed to use urban geography principles to critically evaluate the rationale behind their constructed system in the SimCity compared to a counterpart design in the real-world. This activity greatly advanced students' creativity, originality, and imagination and resulted in multiple interesting cities with unique designs. The findings demonstrated that an immersive educational environment can be a highly effective tool for promoting learning transfer in geography and civil engineering education (Kim & Shin, 2015).

Immersive technologies can greatly help educators implement pedagogical approaches that are aligned with the situated-constructive learning theories. Well-designed simulations and games provide immersive environments with appropriate tools, content, feedback, and scaffolds that are necessary for meaningful cognitive and metacognitive learning and transfer. In such environments learners can explore, observe, question, and learn through peer coaching and legitimate peripheral participation (Dunleavy, Dede, & Mitchell, 2009). That is probably why one of the fundamental goals of educational researchers is to develop the pedagogical games that can create the same level of motivation, engagement and passion produced by some popular commercial video games (Lu et al., 2016; Young et al., 2012).

Discussion

Defining transfer and finding its underlying mechanisms is a challenging task. Researchers are still trying to understand the challenges that learners encounter when they try to extend their knowledge from one context to the other. Most traditional assumptions about transfer are primarily founded on the idea that educating people through instruction, guidance and practice in a particular context can help them gain mastery of a particular task of a domain and this mastery is all that is needed to utilize knowledge in practice. While the modern constructivist theories of learning do not underestimate the role of instruction and practice, they view learning as a whole, integrative process in which learners are actively engaged in the process of their own learning while they receive appropriate instruction, guidance, feedback and opportunities through social interaction and involvement in authentic experiences. Therefore, learning is not merely defined in terms of the cognitive processes that individuals are engaged in. It is also about how individuals evolve in this process and change (Lave & Wenger, 1989; Singley & Anderson, 1989).

This paper reviewed some of the prominent learning and transfer theories such as the theory of identical elements, low and high road transfer, analogy as well as the situated learning theory. While each theory employs effective cognitive and metacognitive strategies such as comparison, assessment, reflection, and generalization, which can significantly improve learning and transfer, each approach has also some limitations that need to be considered when these approaches are implemented in practice.

For example, while the ultimate goal of the identical theory of transfer has been to improve students' application of knowledge through providing similar tasks in similar contexts (with shared elements and features), this theory was criticized years ago by Hendrickson and Schroeder (1941) when they empirically indicated that the ability of formulation of general principles (e.g., the principle of water refraction) was more effective than the presence of highly similar tasks in transfer of training. It was also noted that other factors such as individual differences such as the habit of verifying a judgment or the ability to generalize a principle for oneself highly influenced the amount of skills and knowledge transferred.

Early research on knowledge transfer was mostly directed by the theories that were focused on the resemblance between "conditions of learning and conditions of transfer" (Bransford et al., 2000, p.51) – a difference that was addressed and questioned by later theories. However, are learning and transfer truly different? In answer to the question, Perkins and Salomon (1992) argued that there is no solid line between learning and transfer. However, transfer becomes interesting when it occurs beyond the original context of learning and is not considered ordinary learning anymore – a phenomenon that they called "the hoped-for transfer" or desired transfer. For example, a student may indicate very good vocabulary skills

on the English test (ordinary learning) but not in daily speech (the desired transfer). The student may be quite comfortable with solving the problems on the worksheet (ordinary learning) but not similar questions in an authentic problem-solving context (the desired transfer). The idea of ordinary versus desired transfer can also be explained in terms of “near” and “far” transfer (Kassai, Futo, Demetrovics, & Takacs, 2019; Perkins & Salomon, 1992). Near transfer refers to application of the same knowledge in vastly similar contexts. For example, when students encounter problems similar to what they have previously practiced in their homework or when a mechanic fixes an engine which is similar to the older designs of the same model, the transfer is near. On the contrary, far transfer is about utilizing knowledge in remote and dissimilar contexts. For example, a chess player might apply basic strategic principles of the game such as center control to investment practices or to sports games or an engineer may apply the trigonometric principles to a modern design. It should be noted that the definition of near and far in this context is highly intuitive and, therefore, there is no specific measurement to determine how far or close the events are.

It is important to know that transfer does not always convey a positive concept although by transfer we usually mean learning in one context and improvement in performance in some other context. Negative transfer may also occur when learning in one context negatively influences one’s performance in another context (Chen & Daehler, 1989; Cormier & Hagman, 2014; Perkins & Salomon, 1992). For example, when speakers of one language find it easier to learn related foreign languages, the transfer is positive. However, if differences in pronunciation, vocabulary, and grammar create confusion for the learner and hinder their learning process, then the transfer is considered negative. While negative transfer can be a real and problematic issue in learning, it does not seem as significant as positive transfer in education. This is mainly because negative transfer can usually be problematic in the early stages of learning a new domain and learners often correct their misconceptions when they gain experience in their field of study. Therefore, the main focus of transfer research is to know when, where, and how the desired positive transfer occurs.

Similarly, in applying transfer strategies such as analogical encoding, one needs to be aware of the potential challenges that may arise later. Empirical research indicates that analogical encoding – which occurs through comparison among similar examples and cases – can be highly effective in formation of new concepts, producing general rules, and promoting problem solving strategies (Gentner et al., 2003; Gick & Holyoack, 1983; Hajian, 2018). However, comparison may also lead to overgeneralization and incorrect conservation of variables due to the application of the intuitive rule of “same A – same B” (Ronan, 2018; Stavy & Tirosh, 2000). For example, as Ronen (2012) argues, when two rectangles with the same area (but different lengths and widths) are turned into two cylinders, they end up with the same area but different volume. However, many learners conserve both area and volume under this transformation (as cited in Ronen, 2018).

One way to confront this challenge is to stimulate students’ awareness to their intuitive incorrect responses and challenge their reasoning by employing appropriate prompts and scaffolding at appropriate stages of learning (Hajian, 2018; Lazonder & Harmsen, 2016; Ronan 2018). For example, it is highly effective to prompt students to explain why and how they have abstracted a general rule and what evidence they can provide to support their justification (Hajian, 2018; Holyoak & Thagard, 1996; Hoyos & Gentner, 2017).

There is no doubt that each reviewed theory has its own complexity and challenges in implementation and practice. These challenges are mainly due to factors such as the level of

learner motivation, engagement, attention and prior knowledge. Therefore, novice learners and expert learners may take advantage from the same training in different ways as the association between learning and transfer also depends on the level of knowledge and expertise that learners have previously acquired in the field (Gentner et al., 2003; Hajian, 2018; Kalyuga, Chandler, Tuovinen, & Sweller, 2001).

Transfer is an active, dynamic process and not the final product of some sequential steps in learning or a passive end-product approach. This paper provided some practical educational models such as problem-based learning, communities of practice, cognitive apprenticeship, and game-based learning to indicate that it is possible to efficiently promote learning transfer in a relatively authentic context – *in situ* learning. However, there are still many questions that need to be addressed in future studies. For example, do all skills need to be acquired within a social context to ensure their successful application? How is situated learning implemented in online courses and materials? What kinds of instructional support are required to be provided for learners with different prior knowledge and self-regulatory behaviours? And, how can in-situ learning model be employed in our traditional school system, considering a big volume of material needs to be covered in a relatively short period of time?

In conclusion, learning transfer is a multi-dimensional process that occurs at any stage of learning and can be enhanced through coaching, scaffolding, interacting, assessing and reflecting in authentic contexts. Therefore, if learning transfer fails, the entire learning system needs to be questioned simply because many things might have gone wrong and there are no quick-fix strategies to solve the problem.

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**A Proposed Typology of Knowledge Sharing within Communities of Teachers: A
Comparative Case Study Focusing on England and Macedonia**

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Abstract

This article is a case study of the knowledge that is exchanged by teachers when they are engaged in professional communities that extend beyond the workplace, including internationally. The participants in this study were all teachers from England and Macedonia. The data collection method was via interview. This data was thematically coded and used to build towards the development of a typography of the different forms of knowledge that may be shared by teachers within such communities. In the first half of this article different ways of defining the professional knowledge of teachers, as presented in a range of research, are explored and critiqued. The second half then explores the different forms of knowledge that the participants in this study perceived themselves to have shared as members of communities of teachers that extend beyond the workplace. Via this study it was found that the participants consistently problematised the possibility of directly transferring specific pedagogic strategies. However, stories about teaching were seen by all to be useful vehicles for enabling affirmation and for co-constructing professional purpose. It is argued that both of these outcomes are forms of professional knowledge in their own right. These findings have potential implications for policy and practice as they indicate that it may be significant for those organisations that support such networking opportunities to value and understand the significance of those forms of professional knowledge that are less concrete than the exchanging of specific classroom strategies alone.

Keywords: professional communities, professional knowledge, extended professionalism, communities of practice, pedagogical knowledge, knowledge sharing, implicit knowledge

In many countries, there are a wide range of initiatives that link teachers from different schools within the same country. There are similarly a large number of initiatives that build communities of teachers from different countries. These may be arranged and funded by governments, local and national, or by non-governmental organisations. These organising bodies at some stage usually evaluate the success of these initiatives. The reasons various organisations have for supporting and promoting such community building is often described in terms of improving teachers' knowledge and expertise and in terms of sharing practice (Frost, 2015; British Council, 2018). These often become the success criteria that such communities are judged by.

However, a frequent criticism is that although engagement in extended communities is often a positive personal experience for teachers, they are sometimes not as effective at transferring practice as is hoped for. Often, this has particularly been the conclusion reached by research into the success of international initiatives (Oyewole, 2016). Another criticism, with the building of international communities specifically, is that when the countries involved differ in terms of economic development, levels of investment in education, or perceived teacher status, the relationship between community members is inevitably an unequal one. The potential for inequality is most often demonstrated by an expectation from those from the more developed country that they will have much to teach and less to learn (Steiner-Khamsi, 2014).

Both authors are professionally engaged in developing extended and international communities of teachers. Through this role we have found that current models of teacher knowledge do not fit neatly when trying to understand these communities and especially when trying to evaluate their success. Some models emphasise the importance of the individual school (Frost, 2015), while others are culturally specific (Shulman (2013). These models do not enable a full understanding of knowledge transfer when the teachers in these countries teach very different subject knowledge and when the curriculum emphasises different aspects of student and teacher knowledge and expertise (Schulman, 2013). Therefore, in this paper we explore the different forms of knowledge that the participating teachers perceived that they had shared and the value that they placed on these. This is within the specific context of knowledge sharing within extended and international communities.

Literature Review

Professional knowledge in many professions is defined by a shared specialist language (Stickney, 2012). However, if professional knowledge is defined in this way, then this presents problems if trying to understand the distinct knowledge of teachers (Frost, 2013). Teachers certainly build a canon of knowledge and skills through their career. However, this is framed in language that is familiar language to most people (Taber, 2009), simply because most people have a deep familiarity with the language of teachers and of schools (Ball, 2006). In comparison, in the medical and legal professions the status of having distinct professional knowledge, defined by distinct language and enforced by unique social codes, is easier to attain (Hui & Stickley, 2007).

Other potentially more valid models of teachers' knowledge identify and describe typologies that define the different forms of knowledge that teachers may acquire. Shulman (2013) built and refined a widely used typology of knowledge that defines teaching knowledge in terms of pedagogical, subject content, and contextual knowledge. This way of identifying different forms of knowledge is significant because it distinguishes between potentially mechanistic

acts of classroom strategy and a deeper knowledge of practice, the latter of which enables innovation and responsiveness. It also distinguishes between the factual content knowledge of teachers and a simple knowledge of strategies, both of which can be easily shared, and the tacit knowledge of how to teach well in this context, which is much harder to share with others.

This tacit knowledge, a “wisdom of practice” (Shulman, 2013), is a form of knowledge that is harder to transfer than either subject content knowledge or the mechanistic knowledge of individual classroom acts or strategies (Dogan, Pringle, & Mesa, 2016). However, with Shulman’s model, the primacy given to subject content and contextual knowledge means that it cannot be used as a conceptual tool on its own for understanding the knowledge exchanged by teachers engaging in extended communities that reach beyond a single education system. This is because of the lack of content similarity and the differing curriculums in different contexts. This is exacerbated further if the community is very diverse such as an international community.

Another alternative way of understanding how teachers build and define the professional knowledge they possess, which has been widely used in theory building over the past twenty years, is by reference to arts and crafts traditions (Shimahara, 1998; Lupton, 2013). These analogies link teaching to other highly skilled roles that historically often lay at the heart of communities. This way of understanding teachers’ professional knowledge, especially with reference to craft traditions, has had a deep influence on teacher training in England and Wales in recent years, which has progressively moved towards a way of training which is akin to an apprenticeship model.

One argument for using this analogy to understand teachers’ professional knowledge is based on acknowledging that once formal qualifications to enter the profession have been completed, further professional knowledge is almost entirely gained via experience (Hord & Sommers, 2008; Oancea, 2014). Teachers in professional practice understand situations via the context and interpretation of previous similar experiences (Taber, 2009). These specific experiences are just as inaccessible to others as professional knowledge in other contexts. However, teachers’ knowledge is more idiographic, likely to be expressed in less specialist language and the process of gaining it is done in the real world setting of the teacher’s classroom (Nyman, 2014). This knowledge is still highly specialised though and can only be accumulated by deeply committed professionals over an extended period of time (Parker-Katz & Bay, 2008).

Art and craft analogies are useful tools for understanding the types of knowledge that teachers may possess and share. This is because, with these analogies, a distinction can be made between teaching as craft and teaching as art, whilst defining teaching knowledge is a union of both types of knowledge (Lupton, 2013). Craft involves the accumulation of a broad set of skills, whilst art is the utilisation of these in innovative and unique ways by any given teacher. According to these analogies just as an experienced carpenter will make each piece in a distinct and unique way, but based on prior experience of having dealt with a similar challenge before, so will a teacher when designing lessons and teaching strategies (Black-Hawkins & Florian, 2012). As each challenge is resolved, the store of accumulated expertise and depth of knowledge is extended (van Velzen, 2012).

Artists are interested in other artists’ work because of the creative discourse that is enabled by seeing and discussing it, not because they intend to replicate it entirely. Therefore, whereas in

other professional fields an exact equivalent case may inform the way to address the next, in teaching the myriad range of similar classroom experiences informs later decisions. However, this knowledge is used far more flexibly than it might be in other contexts. A different setting is not simply advantageous or disadvantageous, but leads to different but equally valid decisions being made (Gun, 2014).

Another distinct approach to understanding the knowledge of teachers is the teacher leadership perspective as promulgated by Frost (2014; 2015) and others involved in the International Teacher Leadership Initiative. “Teacher Leadership” is used as a term by various writers. However, two aspects of the teacher leadership approach that Frost (2015) propounds are distinct from other conceptual models. These are the importance of the co-construction of knowledge by teachers, and the importance of knowledge validation by fellow professionals (Creaby, 2013; Frost, 2014), albeit acknowledging that the idea of co-construction is implicitly present in models that use arts as an analogy.

According to this teacher leadership perspective, for knowledge to be relevant to teachers it must be co-constructed as a community (Bolat, 2013). The distinction between co-construction as opposed to simply sharing is important as it is through co-construction that teachers are able to be creative and to exercise leadership (Steel, 2014). Through this process, knowledge is shared through the stories teachers tell and it is then developed in innovative ways as a community. This then facilitates the process of building a positive professional identity and self-efficacy among teachers (Frost, 2014), which in turn facilitates the enabling of embedded, long lasting changes in practice or underpinning viewpoints on education (Hill, 2014).

For this professional knowledge to be of value it therefore undergoes a process of “knowledge validation” (Frost, 2013, p.17) with the teachers in the role of expert practitioner and expert audience. The knowledge that is co-constructed and then validated in the dialogue of teachers may on occasion be specific knowledge relating to classroom strategies but it may also be knowledge of how to exercise leadership, knowledge of purpose, or knowledge of one’s own professional significance (Hill, 2014; Frost, 2013). The emphasis in the context of this teacher leadership approach is on teachers being empowered to innovate. Through the confidence that this builds teachers then develop belief in themselves as leaders of change. The significance of emphasising the co-construction of knowledge rather than the direct transfer of practice has implications when teachers work together across national borders (Underwood & Kowalczyk-Walędziak, 2018). It reduces the risk of strategies being rejected because of an unquestioning acceptance of approaches brought in from other countries, especially wealthier ones (Ramahi, 2015). Ramahi (2015), in the context of Palestine, writes about how the building of collective knowledge as opposed to only individual reflective knowledge enables forms of knowledge other than classroom practice to be exchanged by teachers. This, in her experience, includes knowledge of: personal agency; approaches to leading change; and of teachers’ own role as experts.

To some extent these interlinking definitions of professional knowledge would also be appropriate when defining experienced professionals in any profession including the traditional professions of law and medicine, which were placed in opposition to these models at the start of this section. However, it may be more significant for teachers than for those in other professions (Kuper & D’Eon, 2011; Frost, 2014). This knowledge of teachers, which once a teacher is qualified is largely built experientially, is different from the more procedural knowledge of other professions and therefore is worth understanding in a distinct way (Eraut,

2007; Frost, 2015).

The purpose of this study reported here was to explore the types of knowledge that teachers engaged in extended and international communities shared, and the value that they put on these different forms of knowledge. Two research questions underpinned this study:

- What types of knowledge do teachers engaged in extended communities exchange?
- In what ways do teachers value these different types of knowledge?

Method

The overall design for this study divides into two stages (Newby, 2014). First, there was a preparatory stage which involved an exploration into literature in this field. This first stage built an initial conceptual understanding that would be used to guide the analysis of documents and the interviews. In the second stage, ten interviews with two different groups of teachers were conducted. Interviews were firstly conducted five teachers currently teaching in schools in England, who were all engaged in communities that extend beyond their workplace. For all of them, this involved working with teachers, and others in education, from the Balkans including Macedonia, via “the International Teacher Leadership initiative”. The second group was five teachers teaching in schools in Macedonia who were members of similar communities that extended beyond their own workplace and in some, but not all cases, communities with an international dimension.

The participants from both countries were all teachers within the state system in either England or Macedonia. The five Macedonian teachers all taught in schools that had cohorts of children aged from 7 to 14. The teachers from England were all secondary school teachers (teaching children aged 11 to 16). All had taught for at least one year and none had taught for more than ten. The teachers from England were one English teacher, two humanities teachers, one science teacher, and one dance teacher. Due to the age of the children the Macedonian teachers did not have a subject specialism.

All could be described as “extended professionals” (Hoyle, 2008, p.287) in that they were proactive professionals, constantly seeking professional development opportunities within their schools, their country and beyond to make systematic and purposeful interventions in their teaching practice in order to improve it. In this way they also demonstrate a high level of “professionalism” (Evans, 2008, p.24).

The participants were involved in a range of communities from formally structured projects to online communities that they had created for themselves. The one commonality these communities all had was that they extended beyond the school workplace. They were all also involved in at least one community that was part of the larger, UK based “International Teacher Leadership initiative”. However, in no case was this the only extended community that they belonged to and the participants referred to a range of the communities in which they were involved in their interviews.

The “International Teacher Leadership initiative” provided gatekeeper access to the participants. It is a project that started at the University of Cambridge in 2011 and is now a fully independent initiative. It involves all the countries that have emerged from the former Yugoslavia, plus the UK, Turkey, Portugal and Palestine. The participants’ involvement ranged from being central to the governance of this initiative, to being a teacher involved in

local initiatives inspired by it in England or Macedonia. In all cases though it meant that it might be expected that the participants would have a shared perspective on the ideals of “teacher leadership” that this project puts forward (Frost, 2015). However, this study does not focus exclusively on this project, but rather on the knowledge shared within a range of communities these teachers were involved with, whether formally or informally structured.

Interviews were used because the aims and goals of communities of teachers that stretch beyond the workplace, articulated in the literature of the organisations that promote international networking, tend to be strong, clear, and hard to disagree with. This includes the documents produced via the “International Teacher Leadership initiative”. They variously combine an emphasis on the importance of: democratic participation; enabling civic society; empowering teachers; and on building global communities of education professionals (British Council, 2016; Frost, 2008). These are all values and ideals that any teacher engaged in international networking via formal projects would be likely to concur with. We therefore decided to use interview because such deep data would reveal subtle differences in viewpoint and perception (Robson & McCartan, 2016).

The participants were interviewed in private. The interviews were held in English although both authors were present for the interviews with the Macedonian teachers (one of the authors speaks both English and Macedonian fluently). The same simple interview schedule was used with all the participants from both countries and consisted of four open questions, which would then enable a further discussion. These questions asked the teachers to describe the communities that they had been involved in, their reasons for joining, the knowledge that they had shared within the community, and what they valued most about community membership. From this starting point further discussion emerged. The shortest interview lasted 40 minutes, the longest lasted 70 minutes.

All the interviews were transcribed verbatim. They were then:

- carefully read by both authors with initial codes written in the margin by hand;
- extracts with identical or related codes were grouped together in tables;
- the codes were then reduced and categories identified; and
- these became the categories that shaped the writing of the second half of this article.

Findings and Discussion

This section is a discussion of the forms of knowledge that were exchanged by the participants, when they were engaging in communities beyond the workplace. We also discuss the value the participants put upon the different forms of knowledge that were shared and on the process of sharing.

Knowledge of Strategies and Practice

All of the participants acknowledged the possibility that specific classroom strategies may be exchanged by meeting other teachers through a community that functions beyond the workplace. This reflects Shulman’s model of knowledge sharing, which describes how specific strategies are the simplest and most transferable form of knowledge that teachers share (Shulman, 2013). For the participants this included within international communities that they had been engaged with. However, none of the participants, from either England or Macedonia, felt that the learning of concrete strategies had been particularly significant for them. Therefore, an apparent tension regarding rejecting the simple and mechanistic learning

of teaching strategies, whilst maintaining the goal of achieving concrete change through dialogue with other teachers, was present in all the interviews.

The participants were very interested in how others taught and consistently described how hearing stories about teaching was a vital and stimulating aspect of engaging with teachers from other countries. This closely matches Frost's (2015) and Ramahi's (2015) description of knowledge being present in the discourse of teachers. However, the participants were confident in their own skills as teachers and lesson designers, enjoyed the process of lesson design, and were consistently looking for sources of inspiration rather than strategies that they could simply transfer. They were also interested in current trends and developments as expressed by the teaching of others. This again fits closely with Frost's (2014) teacher leadership model, which describes how experienced teachers perceive themselves as creative and individualistic and therefore seek forms of knowledge other than the direct copying of strategies. This is illustrated below by this quotation from one of the teachers from England.

I kind of just wanted to find out more about it. Colleagues have been abroad before and found it really interesting to hear about teaching in other countries but particularly the obstacles to teaching and how we take it for granted over here. I saw this as a form of professional development, a chance for involvement in something. I expected it to have some kind of influence on my teaching but that isn't the same as learning teaching strategies, it was something less direct that I expected to gain. The vast majority of your time is spent in your classroom by yourself and you are the identity in your classroom. The activities, the lessons have your stamp on them. My lessons have the stamp of other individuals who inspire me. Although I think you could come into my lesson and see a Ms xxxxx lesson, there are other ideas that have fed into that particular lessons and yes that is what I expected or at least hoped for (A secondary school geography teacher from England, engaged projects with teachers from the Balkans).

The knowledge that all the participants sought to build through engagement, in the more diverse communities of teachers that they belonged to, included and emphasised knowledge of the thought processes of other teachers when designing approaches to teaching; knowledge of the working culture that enabled or inhibited this, and a deeper understanding of the interaction between the wider community that they belonged to and the design of innovative lessons. All of these in turn were linked to improvements in teaching within their own schools and classrooms but in a more nuanced way than the simple importing of strategies. The participants saw the dialogue that international engagement, specifically, could bring about between teachers from different countries as ideally being critical, discursive and co-constructed. They also thought that it was important that such discussions would be empowering for the teachers engaged in them.

There was an initiative seven years ago, we were in that initiative, and they taught us that it is great to share your ideas and that was the aim of that workshop and they taught us how to film, to record our classes and to share and that is great, really inspiring, but it was the doing of it that inspired me, to be honest I didn't then copy a lot of lessons but I made friends, interesting people I still talk about teaching with (teacher from Macedonia: engaged in a pan-Macedonian project).

The quotation above is illustrative of how a perception of teaching as an individualistic or idiographic profession was expressed in all the interviews. It was also consistently emphasised that an individualistic approach to lesson design could potentially be positive and enabling. It could even promote greater self-efficacy than dependence on the strategies of others. However, for this to be the case it was seen as important that these teachers still identified as members of a community, thus fitting with E. Wenger-Trayner and B. Wenger-Trayner's (2015) model of a community of practice. This emphasis on individuality and creativity did not negate the possibility of community membership, as long as the expectation was that the knowledge shared would not simply be mechanistic know-how.

Within several of the interviews, as the quotation below illustrates, there was also explicit reference to the idea of teachers' shared knowledge being similar to knowledge in the arts. According to this analogy it may be expected that techniques, approaches and perspectives are shared in order to then enable personal innovation (Lupton, 2013; Oancea, 2014). This may indicate that this is an analogy that these teachers were already familiar with. However, even if this is the case, it is clearly one that resonates.

Solutions are found more quickly if you can undertake reflection with other colleagues but the final design of a lesson needs to be something personal You get involved in designing a lesson, it is like an artist or a writer does (teacher from England: secondary science teacher: engaged with projects in Europe).

All of the participants saw the process of lesson design as highly personal and individual. One participant in particular was very active in presenting her ideas to others via the internet and had built a community beyond the workplace where she was a leader and innovator, presenting her practice to others. However, even in this case, an appreciation of the role of others was still present. She acknowledged that she was often inspired by ideas from others within and beyond this community. In keeping with the analogy that lesson design is similar to the process of being an artist (Lupton, 2013), she never used these in their entirety without modifying and developing them further.

I never use the internet for ideas, because I record my lessons and I picture them. I publish them. So I need to always be creative (teacher from Macedonia: engaged extensively in online, international communities of teachers).

It was interesting that this emphasis on independence and creativity was still the case even though both countries, England and Macedonia, had seen political pressures emerge since 2010 in terms of an expectation of improving the teaching in the respective country via direct international borrowing. In England this has been diffuse and sporadic with various initiatives using China, Finland, Singapore and others as a potential model being promulgated (Frost, 2015). In Macedonia this has been more focused and concrete, specifically the national curriculum and assessment processes were, at the time these interviews were conducted, being re-designed by Cambridge International Examinations, with teaching towards this having already begun with children aged up to eleven (Joshevska & Kirandziska, 2017). Teachers in Macedonia at this time were also having to undergo a large-scale government led assessment of their teaching and subject knowledge as part of this development.

On the few occasions where learning specific teaching strategies were mentioned, all the

interviewees stated that it would be likely that teachers working in England would have more specific strategies to give to others and less to learn. However, these strategies were not those of classroom practice but rather were leadership strategies promulgated by the International Teacher Leadership initiative that they were involved in (Frost, 2013). This therefore reflected the greater depth of embedding of this specific initiative in England rather than a perception that education in England was superior in any more general sense. Contrary to a possible expectation that classroom strategies may be imported from the West (Steiner-Khamsi, 2014; Oyewole, 2016) all of the Macedonian participants perceived there to be no significant difference in quality or approach to teaching between the two nations.

Knowledge of Purpose

Eight of the ten interviewees, from both England and Macedonia, used the phrase “moral purpose” in their interviews. This is language used by writers, who identify themselves as writing in the tradition of teacher leadership (Frost, 2015). This may therefore come from the participants’ involvement in communities that define themselves in this way. However, to the participants it was clearly a meaningful term even when defining other communities that they belonged to. When expanding upon it, a common understanding emerged that linked this closely to ideas of collective-efficacy and empowerment in a similar way to that expressed by E. Wenger-Trayner and B. Wenger-Trayner, (2015). For all the teachers the experience of travelling, when this was possible, was connected to an ambition to work with fellow teachers with similar approaches and values. Indeed, what particularly impressed the teachers from England about those with whom they had worked from Macedonia was their ambitions regarding and focus on improving the education system of Macedonia. These conversations where the teachers were able to find a commonality of moral purpose were particularly valued as a distinct positive that came from being part of this community.

Maybe different experiences and examples are going to inspire them because I think that philosophy is not inspiring teachers who are just listening to a lot of philosophy. I want to convince them that if I can do it, you can do it also (teacher from Macedonia: involved in pan-Macedonian projects).

There are so many involved and dear to me. The initiative gels people together but the individual relationship is more significant still. We synchronised about teacher leadership around having the same values, realising how important what we are doing was, but I definitely feel like I belong to a community of teachers that are seeking for an impact and a change in education (teacher from England: a secondary school dance teacher, involved in projects with the Balkans).

This was also connected for the participants to the establishing of democracy in The Balkans and the rebuilding of civic society. It was the fact that this initiative was working with these countries that drew some of the teachers from England to choose to become involved at an early stage. As regards their role as leaders of civic change, the perceptions of the Macedonian teachers were distinct from the teachers from England and also more homogenous. Some of the teachers from England did not perceive themselves as having a wider civic role beyond their school, while others saw this as a strong feature of their identity as teachers and educational leaders, to the extent that they perceived this role as a global one.

We work with little kids we create in some way the future citizens. So we teach interaction in group cooperation, in groups that is the first way how to be a

great citizen. What I am trying to achieve is that, I try to teach children to become good human beings (teacher from Macedonia: primarily engage in projects in the Balkans).

As this quotation above exemplifies the teachers from Macedonia all perceived themselves as having a role in terms of building civic society. This was also articulated in documents produced by Macedonian writers, linked to the “International Teacher Leadership initiative” (Joshevska & Kirandziska, 2017). In all cases this was primarily linked to and focused on the local community. The Macedonian participants saw themselves as having a leadership role in terms of building social cohesion. However, they saw this as being even more closely linked to teaching than the teachers from England did, with both being an aspect of a common process.

Knowledge that Affirms

For all the teachers, recognition of their expertise by other teachers was significant to them. They emphasised a recognition of the unique skills set innovative teachers have, their role in building civic society, and the importance of resisting becoming mechanistic as regards approaches to teaching. The interviewees strongly identified with the communities beyond the workplace that they belonged to as ones that they took considerable pride in being part of. One form of knowledge that they therefore perceived as being shared when working with other teachers, was knowledge of themselves as professionals and of their shared collective efficacy. This is a form of knowledge that has been previously described by E. Wenger-Trayner and B. Wenger-Trayner (2015). One thing that was consistently welcomed was the opportunity to demonstrate expertise to a knowledgeable audience outside their own schools and to have this expertise recognised, something also noted by Frost (2013) when describing such communities. Thus, one of the gains of working on initiatives with other teachers in this way was the process of being affirmed and of affirming others.

So one of the things we also do in the component is that we set up networking meetings in one school for several schools that are joined. They have a chance to show off, to celebrate their success, something that is very lacking in the teaching profession in general or in Macedonia specifically (teacher from Macedonia involved in projects across Macedonia and with England).

Teachers from both countries saw themselves as being engaged in a conversation between equals. However, both groups of participants identified that this was particularly possible because they identified with the commonality of being teachers and experts in education. From this therefore emerges the fourth type of knowledge that was shared within this community, which was, “knowledge that affirms”. This is the knowledge that one is a skilled professional that can only be gained from the critique of other fellow professionals.

Thus, although distinct, knowledge that affirms, also relates to the other three types of knowledge identified above. All the interviewees described how stories about teaching provided the opportunity to demonstrate expertise to a knowledgeable audience outside the school they usually work in and to have this expertise recognised. To the participants the stories that teachers tell are not simply informative but are more purposeful and inspiring than other types of discussion on pedagogy or practice. All the participants also understood the importance of being prepared to move flexibly between the role of expert and expert-audience.

Based on these findings a typology of knowledge is presented in the diagram below. This diagram was designed by the first author and first presented in a doctoral thesis in 2017 (Underwood, 2017). The four types of knowledge illustrated by the four arrows that emerge are: knowledge of strategies, knowledge of practice, knowledge of purpose and knowledge that affirms. The distinction between the first two of these is that knowledge of strategies, refers to specific classroom-based actions which are both mechanistic and relatively easily transferred; while, knowledge of practice, is a term to describe perspectives on and approaches to teaching and lesson design rather than specific teaching strategies. In the middle of this diagram is a box that represents: communities that are personally significant, and in which knowledge is co-constructed. The arrow at the bottom of the diagram, shows how this knowledge is shared via community engagement but also creates community identity and cohesion. It is these forms of knowledge that need to be understood if those that create, support and fund such projects are to be able to evaluate them effectively.

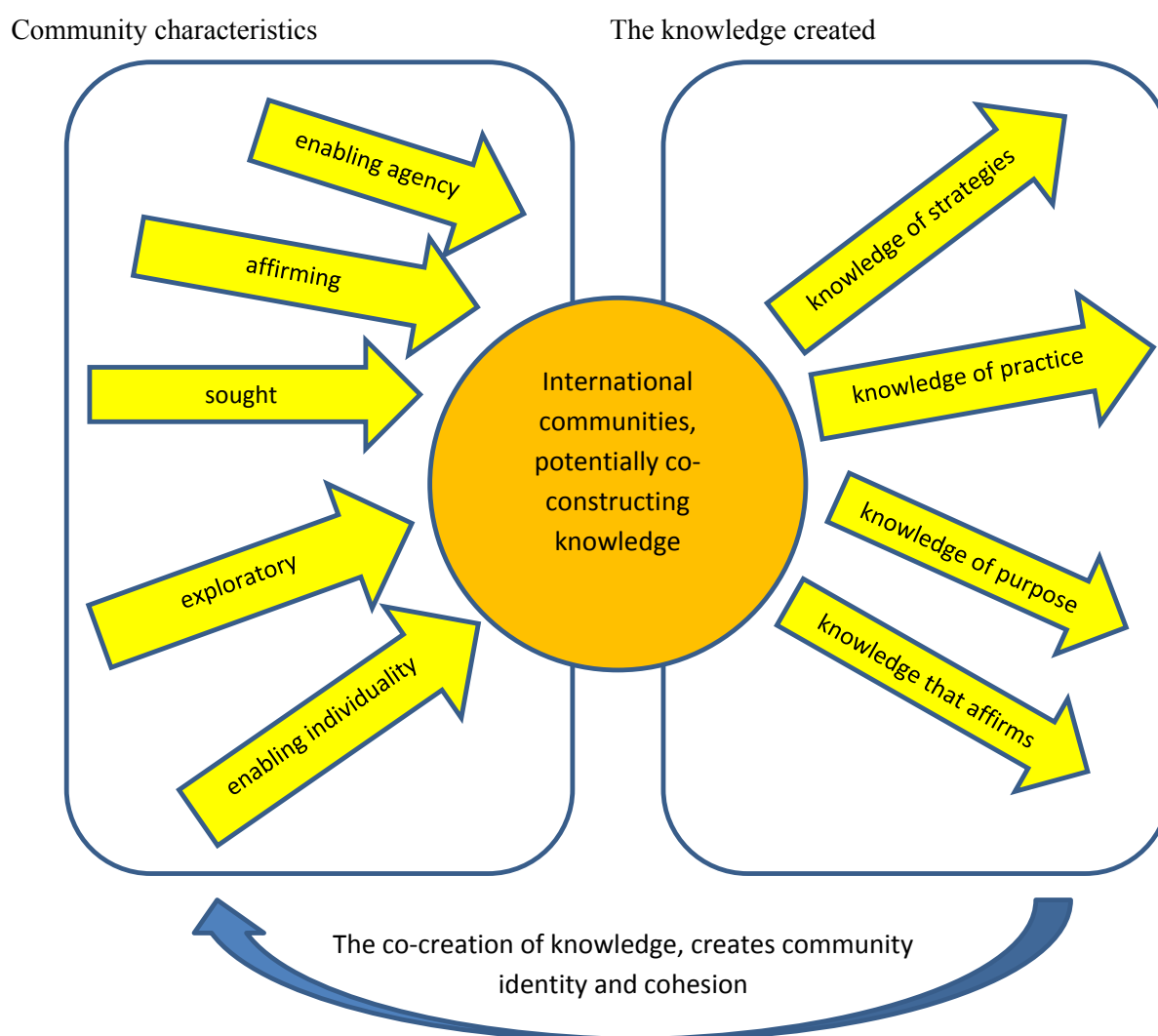


Figure 1: Types of knowledge generated within extended communities of teachers, (Underwood, 2017)

Conclusion

The high regard these teachers put upon the experience of being able to network with fellow professionals suggests that there is value in government, local and national, supporting such processes. Teachers clearly described how being involved in diverse communities, including international communities, had improved their classroom practice and professional confidence. These are all aspects of teachers' professionalism that any school or country would want to develop. However, none of the participants placed any particular significance on the sharing of specific teaching strategies. Instead they stressed the importance of hearing about strategies for designing lessons and for exercising leadership as well as the co-construction of moral purpose. This know-why knowledge was seen to exist in the same discourse as knowledge about teaching strategies but was given far greater primacy. Indeed, stories of know-how for these teachers were largely seen as a vehicle for these other deeper forms of knowledge. Therefore, we would recommend that when such communities are evaluated, by those that lead or fund them, that the value of different types of knowledge is understood, with credence given to sharing knowledge other than the direct transfer of classroom strategies

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