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Doctoral studies in Spain: Changes to converge with Europe in the internationalisation of the doctorate

Magdalena Jiménez Ramírez

Faculty of Education, University of Granada, Campus de Cartuja s/n, 18071 Granada, Spain.

In Spain, the organisation of doctoral studies has been substantially modified to come into line with the changes introduced by the agenda of the Bologna process. These changes have been specified in a number of statements by European Ministers of Education, and have required alterations to Spanish doctoral regulations. The aim of these changes has been to focus doctoral training more on the development of competency as better preparation for research tasks, linking the doctoral candidate with the job market outside university and allowing for the transfer of knowledge within the European context. To this end, Doctoral schools have been set up as a space in which to manage doctoral training, introducing specialisation in research through the design of new doctoral programmes, and means to provide doctoral candidates with mobility for their international training.

Key words: Doctoral legislation, doctoral schools, international mobility, R&D training, transfer of knowledge, funding.

INTRODUCTION

Doctoral studies in Spain and their links with Europe

Several changes have taken place in Spanish universities in order to adapt to the premises of the European Higher Education Area (EHEA) with the aim of coordinating policies and harmonising converging guidelines in an international and European context of excellence. The Bologna Declaration (1999) established two cycles of university teaching, undergraduate and graduate, where the Doctorate was not initially to be found as a basic objective (Castro et al., 2010, 18), but was merely part of graduate study, with more extensive training and no separate identity. This European structure for higher education was later completed with the doctoral level as the Third Cycle of the Bologna Process (Berlin Declaration, 2003), which emphasised "the importance of research and research training and the promotion of interdisciplinarity in maintaining and improving the quality of higher education and in enhancing the competitiveness of European higher education more generally" (ibid. 5), defining it as the first stage of a research career.

The Doctorate and the University were given a fundamental role relating and connecting the EHEA and the European Research Area (ERA) as the basis on which to construct a knowledge society in the European setting. In this context, research should be considered the distinctive element in doctoral and post-doctoral training (Fidalgo and García, 2007), allowing for

international mobility for the research training of doctoral candidates in a clear attempt to provide for a research career that resulted in an international attraction for research and exchange of knowledge.

This harmonisation of guidelines for doctoral studies at a European level has been designed on the basis of several communiqués (Berlin, 2003; Bergen, 2005; London, 2007; Leuven, 2009; Budapest-Vienna, 2010; Bucharest, 2012), in which the European ministers responsible for Higher Education defined the basic conditions for the Doctorate in this context of the knowledge society. In addition, the European University Association (EUA) (2003, 2005a, 2007) has contributed to this delimitation on the basis of several studies and reports containing explicit recommendations for Doctoral Programmes.

The Berlin Communiqué (2003) analyses the function of the Doctorate in a transnational context, and, in its report titled "Doctoral Programmes for the European Knowledge Society", the EUA (2005b) defines Doctoral studies as Third Cycle studies. This EUA report assisted in the adoption of ten basic principles (the Salzburg Decalogue) for the development of Doctoral studies: The advancement of knowledge through original research; the embedding of doctoral studies in the institutional strategies and policies of universities and governments; the diversity of doctoral programmes in Europe; Doctoral candidates as early stage researchers, who make a key contribution to new knowledge; the crucial role of supervision and assessment of the doctoral candidate; the need for critical mass in Doctoral Programmes; the limitation of Doctoral Programmes to a duration of three or four years; innovative organisational structures for interdisciplinary training and the development of transferable skills; the geographical mobility of doctoral candidates and teachers within a framework of international cooperation; the assurance of appropriate, sustainable funding as a guarantee of quality in Doctoral Programmes.

The Bergen Communiqué (2005) takes as its starting point the EUA report setting the Doctorate as the highest level of studies in Europe. It also underlines the importance of establishing doctoral training for research, extolling doctoral candidates as researchers vital to the reinforcement of original, quality scientific knowledge, uniting higher education and research. The London Communiqué (2007) describes the relevance of the role of higher education institutions in the development of knowledge societies based on research and innovation, involving transfer of knowledge. It refers to doctoral candidates (points 2.15, 2.16 and 2.17) and establishes the value of developing Doctoral Programmes linked to the European framework of qualifications, and specifies that "enhancing provision in the third cycle and improving the status, career prospects and funding for early stage researchers are essential preconditions for […]

strengthening research capacity and improving the quality and competitiveness of European higher education."

The EUA later presented another report (2007) titled "Doctoral Programmes in Europe's Universities: Achievements and Challenges", which describes some approaches to Doctoral Programmes and was to be a reference for the following ministerial meeting. In London (2007), the ministers emphasised the relevance of promoting structures of coordination and collaboration with the participation of business. They likewise defended the need for funding of Doctoral studies in order to guarantee reasonable conditions for doctoral candidates, the flexibility of Doctoral Programmes, and the development of training combined with innovation.

The Leuven communiqué (2009) continued to put forward the main themes of mobility, international openness, research and innovation, while also recognising the potential of Doctoral Programmes to provide training for research, complemented by interdisciplinary and stakeholder programmes. The Bucharest Communiqué (2012) focuses on an analysis of the achievements of the Bologna Process and the need to agree on the future priorities of the EHEA, including investment in higher education for the future, providing quality higher education, improving employability and progressing in the field of qualifications. Together with the foregoing, the Communiqué proposes diversity in Doctoral Programmes supporting research in the learning process for third cycle studies and strengthening training and research mobility.

This description of doctoral studies is completed by the contribution of the European University Association (2016), which publishes *Taking Salzburg Forward* through its Doctoral Education Council. This document provides recommendations for the continued application of reforms in doctoral education and further challenges. In essence, it suggests the development of institutional structures for doctoral studies, focusing on the importance of original, innovative research as the hallmark of doctoral training. This requires structures backed up by institutional leadership, integrated into a global strategy of doctoral education and supported with resources and personnel. Moreover, the structure should be open to discussion and debate with a view to reaching a consensus, where the predominant research attitude is one of continuous, communicative dialogue in which discussion and criticism are basic elements of the doctoral candidates' research training. In addition, the document stresses the importance of training the candidates' research capacities by providing finance for research that is not exclusively influenced by research impact indicators, undermining the aim of research with quantifiable aims and products. This would help to give incentive and retain doctoral candidates in the Universities, recruiting talented researchers for the advancement of knowledge and the growth of a research culture characterised by high standards, originality, critical thought and the ability to

create new knowledge.

Some of the challenges mentioned include the need to train candidates in the ethics of and for research, developing them with meticulous methods and taking into consideration the privacy and management of data. Digitalization also represents a challenge in as much as it permits the development of interactive, communicative and participative research through social networks and the Internet. The potential to share information is changing the way research is conducted and creating new opportunities for research and academic dialogue. All of this is taking place in an increasingly global context, in which doctoral candidates participate in international research projects in collaboration with other institutions for the development of intellectual and research careers.

As a member of the EHEA and ERA, Spain has progressively introduced the legislative reforms necessary for the specification and consolidation of university teaching following the principles established in the European context of education and research. In particular, a training model is foreseen for the Doctorate in universities that places the doctoral candidate at the centre of research in R&D projects, allowing for quality, innovation, mobility and internationalisation of researchers in training (European Commission, 2015).

Moreover, links must be established between universities and their Doctoral Programmes with both national and international industry and business, where Doctoral Schools will have a fundamental role. Above all, because these very important transformations in the doctoral stage represent "a methodical training in research in an interdisciplinary, cooperative and international context" (Nebot, 2009), where the Doctorate is ratified as "the distinctive, exclusive trademark of the research university" (ibid.).

Characterisation of the doctorate in Spain: Convergence with Europe

One of the aims of the EHEA is the setting up of a research training network among the member states to permit the development of joint actions of quality in a context of internationalisation. This goal requires the reordering of university studies and, in particular, of doctoral studies. As the highest academic grade, Doctoral studies fulfil a fundamental role, because they represent an essential link between teaching and research, as well as being a basic toll of connection between the university and society (Castro et al., 2010).

In order to meet this challenge, a process of regulatory modification has been carried out on doctoral studies in Spain, leading to the present structure. This trans-formation has been complex on both the bureaucratic and administrative levels (Jiménez and Sevilla, 2016), with difficulties that have led to it being called a tortuous

process (González García, 2009), and inasmuch as four successive sets of regulations have taken place for the doctorate.

Royal Decree (RD) 99/2011 is at present in force, regulating the basic requisites for doctoral studies to converge in research training and stipulating a type of organisation that has been put into effect in university statutes.[1] The Doctorate "is understood as the third cycle of official university studies, leading to the acquiring of skills and competency related to quality scientific research" (ibid., art. 2.1.). For the knowledge society, highly qualified doctors in research and in scientific and technological production represent a first-class strategic value for introduction into the productive sector (Benito et al., 2014). For this reason, the basic premises of the ministerial order are aimed at training researchers in the universities to generate highly qualified human capital, since the universities are responsible for the creation of Ph.D. holders. The basic premises of doctoral studies are described as follows.

Doctoral schools

The main innovation is the creation of Doctoral Schools, defined as: "An unit created by one or more universities and in possible collaboration with other Spanish or international organisms, schools, institutions and entities with R&D activities, with the basic aim of organising the Doctorate within its sphere of management in one or several branches of knowledge or with an interdisciplinary character" (RD 99/2011, art. 2.4.).

As a specific structure of doctoral training, the Doctoral School is set up as an independent unit competent in research matters, with leadership in its structure to organise and manage the offer of activities inherent to scientific research training in a field of knowledge (ibid. art. 9). In addition, its priority is to build collaborative links with R&D centres on a national level, but particularly on an international level. It carries out training procedures for doctoral candidates and establishes the lines of research for doctoral theses, giving priority to the research capabilities of candidates in order to contribute to society through the transfer of research results, insofar as students under research training "must lead and cooperate in the transfer of knowledge to further the welfare of society" (ibid., p. 13911).

The doctoral schools are presided by a Management Committee and an Academic Committee, which can organize their activities in one or more specialised or interdisciplinary fields. The Management Committee (ibid., art. 9.6) consists of, at least, the Director of the School, the coordinators of the Doctoral Programmes and representatives of collaborating bodies. The Director, appointed by the University Vice-Chancellor, must be a researcher of recognised prestige as demonstrated by his

being awarded at least three periods of research activity as defined by RD 1086/1989 on university staff wages, also known as six-year research awards[2]. This Committee is entrusted with the organization and management of the Doctoral School.

The Academic Committee is responsible for programming doctoral studies in training and research. It must be made up of Ph.D. holders designated by the university, and who can also be members of other national or international public research bodies (RD 99/2011, art. 8). Its functions include assigning a tutor to each doctoral candidate, the assigning a supervisor for each doctoral thesis, the annual evaluation of the doctoral candidate's research plan, and the authorisation for presentation of doctoral theses.

Universities can set up Doctoral Schools according to the provisions of their statutes and the regulations of their respective Autonomous Communities, in order to organise the teaching and activities appropriate to the Doctorate. Notification must be given to the Ministry of Education, Culture and Sport for inclusion of a new Doctoral School in the Register of Universities, Centres and Degrees.[3]

Doctoral programmes

Specialisation in research training involves a very significant restructuring of third cycle studies in Spain. Previously, there were numerous Doctoral Programmes managed exclusively by university departments, with research centred on their respective fields of knowledge and directed towards the training of university teaching staff, with no common comparative framework. Later, interdepartmental, interdisciplinary and interuniversity doctorates were wet up with the aim of strengthening lines of research based on a Doctorate. This process meant that Doctoral Programmes could apply for the Mention of Quality, which gave those programmes gaining the award better funding, better recognition of the participating teaching staff and the possibility to invite prestigious international instructors (Sevilla, 2012). On this question of the Mention of Quality, a survey of the participants in the XI ANECA Forum[4] showed that "the national or international Mention of Quality was chosen by over half the respondents as the most suitable manner of ensuring quality in Doctorates" (ANECA, 2009:109).

The present structure of doctoral teaching resides in the Doctoral Programmes, which must be verified by the Universities Council, accredited by ANECA evaluation (Annexe II, RD 99/2011) and have a Coordinator, who must have supervised at least two doctoral theses and be a recognised researcher with at least two six-year research awards. If this last criterion is not possible, similar merits may be authorised.

The Programmes are defined as "a set of activities leading to the acquisition of the skills and expertise necessary to obtain the title of Doctor" (RD 99/2011, art. 2.2). Their goal is to give doctoral candidates the training required to become competent researchers, setting up lines of research for doctoral theses in Doctoral studies independent from the teaching appropriate to other cycles. This training is linked to and supported by competitive groups and research projects, despite the fact that in Spain research groups have "a poorly defined or undefined status" (Nebot, 2009).

This new approach reduces the variety of departmental Doctoral Programmes to a smaller number that can be carried out by a single university or several in collaboration, with the basic goal of training doctoral candidates in scientific research and the possibility of the participation of other bodies with R&D activities. The Ph. D. no longer fulfils merely the training function for university teaching. It has been restructured to contribute, on the one hand, to the preparation of researchers that can join the job market outside the academic sphere, and, on the other, to a reorientation of the professional, social and labour prospects of doctoral candidates.

In the reorganisation of Doctoral Programmes, therefore, universities must count on "external allies", that is, the collaboration of institutions, bodies and entities to promote synergies and R&D strategies, allowing them to create potentialities for research and funding in order to consolidate quality and excellence in research training to go beyond the academic sphere. This means that the orientation of Doctoral Programmes must promote the mobility of doctoral candidates and the internationalisation of teaching, whether by receiving students from other countries, promoting visits by doctoral candidates in foreign universities, incorporating foreign teaching staff and doctoral candidates, or by promoting the "International Mention" of the doctoral theses produced by the Programmes.

To this, we might add that the Doctoral Programmes can apply annually for the "Doctorate of Excellence"[5], awarded annually to Doctoral Programmes for outstanding achievements in results and a high level of internationalisation. This allows for the internationalisation of visiting teaching staff and greater support for resources, in particular, more research scholarships (Sevilla, 2012).

It has, therefore, become possible for Doctoral Programmes to train candidates to lead the transfer of knowledge with the aim of contributing to society's welfare and development, to become integrated into the social, productive and business sector depending on their research capabilities. It is important to establish links between doctoral training, research careers and the transfer of knowledge. This is a significant challenge, inasmuch as only 19.8% of Ph. D. holders active on December 31st 2006 were employed in the sector of businesses and non-profit making private institutions,

44.4% had jobs in higher education, and 35.8% in public administration (Cortina and González, 2009: 27).

A more recent study by Benito et al. (2014) also found that "the number of doctors employed in the private sector in Spain in 2009 was less than 16% of the total, which give an indication of the breach existing in terms of innovation," insofar as "Spain has as much as 50% less Ph.D. holders employed in the productive sector than the average of other OECD member countries. Spain, 43% of R&D funding comes from private sources, whereas the average for OECD countries is 61%" (ibid., 9-10).

Doctoral competencies

Doctoral Programmes should be put into effect with emphasis on training of doctoral candidates for research and on the acquisition of a set of basic competencies that are transferrable to institutions in the social setting in pursuit of a sustainable economy. The competencies are defined by the "Dublin Descriptors" (MECD, 2005) and are included in the Spanish Framework of Qualifications for Higher Education (MECES) of Royal Decree 1027/2011.

The specific competencies included in the doctoral regulations (RD 99/2011, art. 5.1) are as follows: The systematic understanding of a field of study and command of its research skills and methods; the capacity to conceive, design or create, put into practice and adopt a substantial process of research or creation; the capacity to contribute to the broadening of the frontiers of knowledge through original research; the capacity to undertake the critical analysis and evaluation and synthesis of new and complex ideas; the capacity to communicate with the academic and scientific community and with society in general about specific fields of knowledge in the manner and languages commonly used in the international scientific community; the capacity to promote scientific, technological, social, artistic or cultural progress in academic or professional contexts within a society based on knowledge.

In addition, Doctoral Programmes should also provide professional training for fields requiring creativity and innovation, with the candidate acquiring personal capacities and skills for the following tasks: coping in contexts with little specific information; finding key questions to be asked in order to solve a complex problem; designing, creating, developing and undertaking new and innovative projects in their field of knowledge; working both as part of a team and independently in an international or multidisciplinary context; integrating knowledge, confronting complexity ad formulating judgements with restricted information; the intellectual criticism and defence of solutions (ibid., art. 5.2).

As Nebot (2009) stated, the essential competencies to be acquired by the doctoral candidate must be disciplinary (demonstrating understanding in a field of study), methodological (demonstrating command of research methods), and instrumental (demonstrating command of research techniques), as well as generic or transferrable. The disciplinary and methodological competencies are acquired during training in the doctoral programme, and the methodological during the development of the doctoral thesis, but the most difficult step is found in the transferrable competencies, to be acquired institutionally and through Doctoral Schools. This latter difficulty is also suggested in the survey carried out at the XI ANECA Forum, inasmuch as those surveyed thought that "job opportunities offered by a Ph.D. are more useful in the university than in business" (ANECA, 2009).

Teaching staff: Tutoring and supervision

The present regulations have brought changes to teaching staff through the introduction of the figure of the thesis tutor, which is yet to be consolidated. The tutor is the person responsible for choosing suitable training activities for the candidate among those on offer in the Doctoral Programme (RD 99/2011, art. 2.7). The activities are recorded by the tutor for monitoring and evaluation in the candidate's Activities Document.

The supervisor is the more important figure, having maximum responsibility for the doctoral candidate's research tasks (ibid. art. 2.6), considering the coherence and suitability of the training activities and the impact and novelty of the doctoral thesis in its field of knowledge (ibid., art. 12.1). The functions of both tutor and supervisor of a doctoral candidate must be recognised as part of the staff's teaching and research activity (ibid., art. 12.3).

Both the tutor and the supervisor are charged with a number of functions that are key to the candidate's training. Together with the priority on research, the present regulations lay particular emphasis on stimulating the transition of doctoral candidates to the job market and facilitating the publication of their research results. These functions underline the need for doctoral training to go beyond the traditional orientation towards university teaching and connect it with society as a whole and incorporation into the job market, as well as the dissemination of the products of research.

All teaching staff on a Doctoral Programme must themselves be Doctors, which is only reasonable, notwithstanding possible collaboration in activities that qualify in the respective field of knowledge. In addition, accredited research experience is required for both tutor and supervisor of a doctoral thesis in the form of at least one six-year research award or equivalent merits to be evaluated by the Academic Committee. This is the most highly valued question in some research (Castro et al., 2012), inasmuch as participating staff's accredited

research experience is considered highly relevant, although in practice this has led to the exclusion of some staff formerly involved in this level of training.

Access to doctoral studies, research plan, international doctoral thesis and examining board

Doctoral studies are defined as autonomous and independent of teaching in other cycles, inasmuch as there is a clear distinction between the second cycle (Master's Degree) and the third (Doctorate), oriented towards the development of training specialised in research. Access to the Doctorate is therefore only available after prior postgraduate training (Master's Degree), although the regulations also set out other cases of temporary transitory adaptation according to the previous degree structure (RD 99/2011, art. 6.2). The Doctoral School establishes the requirements and the process for admission of candidates.

On being accepted to a Doctoral Programme, candidates must present a research plan (ibid., art. 11.6), which is evaluated by the Academic committee and must include, at least, the methodology to be used, the goals to be achieved, as well as the means and timescale for the research. This plan must be carried out with the aim of presenting a doctoral thesis recognised as an original piece of research that advances knowledge and capacitates the candidate for unsupervised activity in the field of R&D (ibid. art. 13.1).

In Spain, a doctoral candidate's training and preparation of the doctoral thesis are linked with the possibility of the award of a scholarship contract permitting exclusive dedication to the preparation of a quality thesis. The most prestigious scholarships are those awarded through national public competitions and are known as University Teacher Training and Research Personnel Training grants. These awards are reserved for a few students with good curricula and, above all, an outstanding academic record (Jiménez and Sevilla, 2016). The study by Cortina and González (2009), covering the period from 1990 to 2006, found that grants are the main source of funding for doctoral studies, where 41.2% of candidates recognised having received funding from Spanish institutions (p. 25). Nebot (2009) also considered the priority of "ensuring suitable funding for doctoral training and not as a by-product of general funding" (p. 12).

The new guidelines also include several changes regarding the defence of the doctoral thesis (RD 99/2011, art. 14). Both tutor and supervisor must give favourable reports and there must be authorisation from the Academic Committee of the Doctoral Programme, together with the proposal for the examining board. Another requisite is that the board must be made up exclusively of Doctors, with one six-year research award

or equivalent, and that the majority of members of the board should be external to the University where the thesis has been prepared and is defended, and should not be active on the Doctoral Programme. Examining board members are appointed by the Management Committee of the Doctoral School at the proposal of the programme's Academic Committee.[6] Grading of the doctoral thesis has also been modified by RD 534/2013, which establishes that an examining board shall make public its report and the overall grading for the thesis according to the following scale: not suitable, pass, outstanding and excellent. The board may also award a distinction if the overall grade is excellent and this award is agreed unanimously by secret vote.[7]

In addition, it should be noted that some universities required the doctoral candidate to be the author of a publication related to the thesis in a journal included in the JCR Science Citation Index, or the Scimago Journal Rank (SJR), and holding a relevant position among those of its category, to be defined by the Academic Committee. However, this criterion is not upheld in all Doctoral Programmes because of the difficulty of publishing in certain fields of knowledge in this type of journals. For these areas, the publications must fulfil the requirements set out by the CNEAI and specified by the Academic Committee, where the articles published meet other relevant quality criteria (indexed, journals, peer reviews, international referees, scientific committee, editorial committee, and editorial council) and on occasion are in process of being published. This approach favours "(…) the need for universities to achieve high levels of research productivity, a goal assisted by the publications that doctoral candidates must achieve prior to being awarded their Ph. D." (Badley, 2009; cited in Ortega, 2014, 6).

It is also possible for the doctoral candidate to present a thesis consisting of articles or a "compendium of publications" (Ortega, 2014) rather than by means of the procedure described above. This is not a novel procedure in Spain, although "it is not known when it first appeared and how common it now is" (ibid., p. 5), "it is not state regulated" (ibid.), but "it has appeared as a result of university autonomy" (ibid.) and is now accepted by most Spanish universities.

The student who successfully completes the doctoral courses is entitled to the degree of Doctor of the University U, where U indicates the name of the University in question, as recorded in the RUCT. The award of the Ph.D. shall include information on the Doctoral Programme attended (RD 99/2011, art. 11). The doctoral degree may include the mention of International Doctorate (ibid., art.15), meaning that the doctoral candidates must have spent at least three months in other research centres and/or foreign universities, in the EU or elsewhere; have presented and defended part of the doctoral thesis (summary and conclusions) in the

customary language for scientific communication; have presented two favourable reports by international experts and Doctors who may not have sat on the examining board of the thesis; and that at least one international expert Doctor other than the person responsible for the candidate's activity outside the home university, has been a member of the examining board.

STATISTICAL DATA

We here describe some statistical data on the implementation of RD 99/2011, based on the available university statistics (MECD, 2015; Hernández and Pérez, 2015; University Register of Catalogue of Degrees, RUCT). Regarding the *Doctoral Schools*, there are 1042 university centres distributed over a total of 82 universities (Hernández and Pérez, 2015). Not all universities have founded Doctoral Schools. Those that have been set up are 55 Doctoral Schools, 1 School for Doctoral and Postgraduate Studies, 1 School for Postgraduate and Doctorate, 2 Schools of Master and Doctorate, 1 International Postgraduate Centre, and 1 School of Doctorate and Research, all belonging to (private and public) attendance universities (RUCT).

Regarding the denominations, Doctoral School has been chosen for the majority, only 6 universities have brought together Master and Doctorate, or Postgraduate, including doctoral training in the latter, 16 universities include the adjective "international" in the name of the school, and one other university chose the name "International Postgraduate Centre." Most of the Doctoral Schools have been set up in public universities (48), although there are also some private universities (13). The trend has also been to set up one Doctoral School per university, with the exception of the University of Granada, which has created three Doctoral Schools.

In distribution by Autonomous Community, Andalusia has the most with 13 Doctoral Schools, Catalonia has 10 and 1 School for Postgraduate and Doctorate, the Community of Madrid has 8 and 1 School of Doctorate and Research, the Community of Valencia has 6, Castile and Leon has 5, the Region of Murcia and Galicia have 3 each, the Foral Community of Navarre has 2 and the Canary Islands have 1 Doctoral School and 1 School for Doctoral and Postgraduate Studies, the remaining Autonomous Communities have 1 Doctoral School each, except for Extremadura, for which there are no records, and the Principality of Asturias, although the latter has an International Postgraduate Centre. Most of the Doctoral Schools are in public universities. There are Doctoral Schools in private universities in Catalonia (4 Doctoral Schools and 1 School for Postgraduate and Doctorate), Madrid (3), Andalusia (2), and Castile and Leon, the Community of Valencia and the Region of Murcia have 1 Doctoral School each.

The Doctoral Schools of each university offer different *Doctoral Programmes* evaluated and verified by the ANECA. The RUCT records a total of 1267 Doctoral Programmes, of which 659 are Programmes adapted to the EHEA and are at present regulated by RD 99/2011. The remaining 608 Programmes are Masters degrees and Official Doctoral Programmes and Official University Postgraduate Degrees regulated by the previous legislation and due to be discontinued. Although the Doctoral Schools are registered with the RUCT, not all their Doctoral Programmes have been registered, although their web pages show that they do offer Doctoral Programmes adapted to the new regulations.

It should also be noted that of all the Doctoral Programmes regulated by RD 99/2011 and registered in the RUCT, only a few are shared by more than one university. The Doctoral Programmes can be grouped under their respective Doctoral Schools, as in the University of Granada, for example, or they can be classified by fields of knowledge (Arts and Humanities, Health Sciences, Natural Sciences, Engineering and Architecture, Social and Legal Sciences). Depending on the university, Doctoral Programmes can also be offered that deal exclusively with a single theme, such as at the University of Cadiz, whose International Doctoral School on Marine Studies (EIDEMAR) has Doctoral Programmes specifically on this question.

Concerning the number of *students registered* for Doctoral Studies, the preliminary statistical data of the MECD for 2014 to 2015 on university students show that, according to the regulations of RD 99/2011, the total number of students registered is 28,546. However, we should specify that there are still students registered for Doctoral studies under the previous legislation that have yet to conclude their studies. Hernández and Pérez (2015) calculate that there were 85,390 students registered for the year 2013 to 2014, representing 5.69% of the total of students registered in 1st and 2nd cycles, First Degree, Masters, Short Courses and Doctorate, mainly in public universities.

Despite the fact that Third Cycle students are a minority percentage, the data indicate that an increase is taking place in the number of students registered in all Spanish universities, both public and private. Specifically, the 74,648 Third Cycle students during the 2008-2009 academic year have grown to 88,732 Doctoral students for the year 2013 to 2014 (Hernández and Pérez, 2015). According to the numbers of students registered under the regulations of RD 99/2011, there is a rather equal split between male (50.20%) and female (49.80%) students. However, differences are to be found among students registered according to branches of knowledge and sex.

Regarding student registration by *branches of knowledge*, the Social and Legal Sciences have the highest numbers (26.72%), followed by Health Sciences

(22.99%), Engineering and Architecture (18.23%), Arts and Humanities (17.82%) and Natural Sciences (14.24%). Female students are more common in Health Sciences (14.52% vs. 8.46%), Social and Legal Sciences (13.53% vs. 13.18%) and Arts and Humanities (9.56% vs. 8.26%), although the differences in the last two branches are slight. On the other hand, male students are more common in Engineering and Architecture (12.79% vs. 5.44%) and Natural Sciences (7.50% vs. 6.73%). The most notable differences, therefore, by sex and branch of knowledge are found in the Health Sciences, where female students predominate, and in Engineering and Architecture, with a more significant presence of male students.

These data show that, despite the democratic consolidation of women's gaining access to university education, their presence continues to be unequal in some branches of knowledge and in the categories of research thought to entail greater prestige and social recognition, thus leading to an unfavourable gender bias in women's scientific careers (Villarroya et al., 2008). This question also occurs in the access to Doctoral Studies and the differentiation between the branches of knowledge chosen by male and female students, and, even, in the percentage of women with management positions, which is still low (Grifoll, 2009).

DISCUSSION AND CONCLUSIONS

The process of adjustment undertaken to come into line with the EHEA and the ERA has involved introducing modifications throughout the regulations of university studies, which have without doubt had more specific effects on doctoral training, which leads to the university's most significant academic and educational degree inasmuch as it contributes to the knowledge society. The priority is to create a network for training and research among EU member states to promote internationalisation, recognition, mobility, innovation and transfer of knowledge of doctoral candidates.

To create this structure, the main change has been to provide the Doctorate with its own identity, training candidates in competencies for research and contributing to create knowledge for scientific diffusion, as well as connecting candidates with the job market, with the aim of "seeking new sources of sustainable growth" (RD 99/2011, p. 13190). The key organisational structure are the Doctoral Schools, which manage doctoral training for research through the Doctoral Programmes, which must in turn provide a multidisciplinary culture within the framework of an internationally visible scientific project that prepares the candidate for outside employment.

Consequently, The Doctoral Programmes redirect training towards prospects of employment beyond the traditional academic career, laying emphasis on the importance of improving research skills, which reinforce Doctors as leaders in innovation, as well as training in transferrable competencies to improve employability (Nebot, 2009). However, we must not avoid the fact that Doctors' access to the job market does not only depend on their university training. What is required is "a boost in public and private R&D activity" (Benito et al., 2014:9), because "both public and private investment in research and innovation is without doubt a fundamental part of this structure" (ibid.).

The employability of Doctors is therefore key inasmuch as it contributes to reinforce the links between university and industry, increasing the chances of employing highly qualified personnel. Cortina and González (2009) state that "this segment of the working population is considered crucial for the production, application and diffusion of knowledge and it is, therefore, key to the competitive improvement of the country" (p. 23). Analysis shows that such personnel are almost fully employed (ibid., p. 27; Benito et al., 2014:9). However, the main challenge resides in bringing about change such as to dissociate the employment of Ph.D. holders from higher education and public administration, increasing the recognition and employability of Doctors in the private sphere, as to date they are a minority working on their own account or in the private sector.

In addition to the above, this change in direction for the Doctorate still has other challenges. The first of these is to increase public funding of the university (Gutiérrez-Solana, 2010), which should likewise be greater for R&D projects and contribute to training in Doctoral Programmes. It would thus allow doctoral candidates to pay for their training through scholarships, as well as the mobility associate with the funding of the Programmes themselves. Nebot (2009) is firm on this point: "the research career must be clearly defined and a status defined for the doctoral candidate, which, in my view, should take the form of a temporary contract and not a grant" (p. 19). Horgué (2012) states that funding is an important challenge that universities must take on in order to offer opportunities that redirect doctoral training towards research.

Secondly, if evaluation and transparency must be in place in order to guarantee quality in doctoral training, it would also be important for evaluation to be redirected towards implementation of the doctoral regulations, to bring out their weaknesses, threats, strengths and opportunities in practice, when it comes to selecting teaching staff for the Doctoral Programmes by accreditation of their research and to obtain funding for research (Jiménez, 2017). Moreover, it is a priority to set up more R&D projects, so that the teaching staff can carry out research activity, allowing them to consolidate their research career through the accreditation of six-year awards (Jiménez and Sevilla, 2016). This would also have positive effects for the training process, and the

supervision and monitoring of the development of doctoral theses by the Doctoral students.

These challenges are important if the aim is to increase the numbers of third-cycle or post-graduate students, which are at present in the minority (Hernández and Pérez, 2015), and encourage students from other countries, thus making Doctoral Studies competitive and internationally attractive, which is yet to be achieved (Nebot, 2009). It should not be forgotten that in certain fields of knowledge, such as the Social Sciences, doctoral training must be developed specialising in the need to establish links with the job market in the fields of research and innovation.

The analysis presented here shows that, despite the increase in the number of students taking doctoral studies, training in third cycle studies is only undertaken by a minority (Hernández and Pérez, 2015), mainly in public universities. The majority of these students are mainly Spanish nationals, followed by students from Latin America and the Caribbean and, to a lesser extent, other nationalities. These data suggests that, for the moment, doctoral studies have not become internationalised, with student flows basically "from South to North and East to West" (Nebot, 2009: 14), in other words, towards countries offering better conditions for doctoral candidates and Ph.D. holders.

The data on doctoral studies show an unequal distribution by regions (Autonomous Communities), with the majority of doctoral students to be found in Madrid, Andalusia, Catalonia and Valencia. Although the total numbers are equally distributed by sex, the choice of doctoral studies by speciality shows differences, with predominantly female students in Health Sciences, but predominantly male students in Engineering and Architecture. Villarroya et al. (2008) found that natural science degrees have a gender bias, causing imbalance in the choice of specialities for doctoral studies. The findings of the Higher Council of Scientific Research (2015) were similar, detecting unequal distribution by sex of scientific personnel according to research field, thus showing that this is also a social challenge.

Notes

1. Several aspects of Royal Decree 99/2011 have been modified by Royal Decree 534/2013 (July 12): 1. The period in which official documents, including the Ph.D., must be presented for renewal of the accreditation procedure has been extended by two academic years; 2. The validity of the doctoral programmes drawn up under Royal Decree 1393/2007 (October 29) has been extended for one further academic year until their definitive expiry on September 30 2017; 3. The scope of the grades to be applied by the examining board of a doctoral thesis has been broadened.

2. Six-year research awards represent a productivity incentive for university teaching staff (with tenure) meant to encourage research activity through evaluation by the National Committee for Evaluation of Research Activity (CNEAI). University teaching staff can request such evaluation once every six years by submitting their publications to the Committees appointed to this effect. Some Spanish universities also allow staff under contract (without tenure) to request six-year research evaluation, although if granted, these do not carry any financial award.

3. The Doctoral Schools in Spanish universities and their officially registered Doctoral Programmes can be consulted on the Ministry of Education's website at: https://www.educacion.gob.es/ruct/consultacentros?actual=centros

4. Through its various programmes, the National Agency for Quality Evaluation and Accreditation is responsible for evaluation of everything related to university quality.

5. Through the "Mention Programme" the ANECA evaluates Doctoral Programmes that apply for a Mention of Excellence, although this distinction has not been announced since the 2011-2012 academic year.

6. Despite all these novelties in the setup of the examining board, Doctors from outside the university in question are not always chosen at random from all the experts in the particular field, but are often proposed by the Thesis Supervisor, thus making up *ad hoc* boards to guarantee the "cum laude" mention for their candidates theses.

7. The change in regulations to ensure higher quality of theses has not prevented over 90% of theses defended form obtaining the highest qualification (cum laude) in the University of Granada (Jiménez and Sevilla, 2016).

Conflicts of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

An investigation of problem-solving skills of pre-service science teachers

Asiye Bahtiyar* and Bilge Can

Pamukkale University, Turkey.

Advancements in science and technology have created problems for some people who have difficulties adapting to the new environment. Improving problem solving skills of these people is very important for them to so have the ability to cope with new problems. From the education perspective, it is believed that teachers should help students by not only giving them information on how to solve certain problems but also how to assimilate problem solving skills. Teachers should first and foremost have these problem solving skills so that they can help their students. In this context, the aim of the current work is to study pre-service science teachers' problem-solving skills and to determine the effect of science teacher training program on pre-service science teachers' problem solving skills based on their grade levels. 76 freshmen, 81 sophomores, 117 juniors and 69 seniors (that is, 343 pre-service science teachers in total) of the Department of Science Teacher Education in 2012 to 2013 academic year participated in this study. In order to measure their problem solving skills, problem solving inventory (PSI) which was developed by Heppner and Petersen and adapted into Turkish by Şahin, Şahin and Heppner was used. In the data analysis procedure, One-Way ANOVA was used to determine whether there is any statistically significant difference among grades, scores of problem solving skills, and its dimensions. According to the findings, significant differences were found between sophomores and juniors; and also between sophomores and seniors. As for the sub dimensions, there was only found a significant difference according to "impulsive style" and "avoidant style" dimensions among grades.

Key words: Problem solving skills, pre-service science teachers, teacher education.

INTRODUCTION

Recently, learning science entails solving practical problems by doing investigations. Also, there is less emphasis on the early stages of acquiring special knowledge unlike what it used to be (Peacock, 2005). Science is considered as one of the most important subjects in school. However recently, traditional teaching methods are criticized due to their inability to trigger critical thinking, cognitive skills and a holistic learning environment for children. Rather than teaching only facts, the subjects are expected to develop science process skills where children can observe, measure, classify, process information on their own, interpret, think about solving problems, formulate conclusions, etc. (Kirtikar, 2013).

As learning theories evolve, the understanding of the problem-solving processes also evolves. The prominent learning theories are conceptualized as behaviorism, cognitive psychology, and information-processing domains. Specifically, from behaviorists' point of view, problem solving is a process which develops through positive and negative reinforcement mechanisms. On the other hand, cognitive psychologists view it as a process which includes introspection, observation, and the development of heuristics. Finally, the information-processing consideration of problem solving is based on general problem solving skills and artificial intelligence (Hardin, 2002).

If the information-processing model of problem solving is seen as a model of social skills, it would be reduced to social and interpersonal contexts only; because, self-appraised effective problem solvers use information cognitively and engage it in an appropriate behavior in that process. If, however, the model includes more than social skills, self-appraised effective problem solvers might demonstrate abilities in recognizing and using adaptive strategies in a broader context instead of only social and interpersonal situations. For example, optimal adjustment in an academic setting requires adaptive behavior in domains rather than social skills. Moreover, in order to perform successfully, college students must have some skills such as organizing their time, studying course materials and certain requirements of the program effectively, in addition to be able to fulfill academic requirements for passing the courses successfully (Elliot et al., 1990).

Problems solving requires complex cognitive skills which characterize one of the most intelligent human activities. As from childhood, individuals actively solve various types of problems. They acquire information first, and then organize it into structures of knowledge about objects, events, people, and store them in their memories. These structures of knowledge originate in understanding mental models, convictions, and beliefs which influence people's way of putting those experiences together and solving the problems of daily life, school, and business life (Chi and Glaser, 1985). More specifically, problem solving includes some components as follows:

1. Taking time for a deep understanding of the nature and detail of the problem including its limitations (for example, time, scarce resources etc.).
2. Agreeing about a successful solution or outcome.
3. Considering different ways of dealing with the problem, rather than simply focusing on the ones in front.
4. Deciding on the best approach indicating success.
5. Making a systematic plan and implementing it with the chosen approach,
6. Evaluating whether the problem has been solved.
7. Making implications about the whole procedure in order to improve the approach for the next problem solving experience (The Key Skills Support Programme; KSSP, 2005).

Therefore, it can be stated that problem solving is the key skill which develops students' ability to think about situations, issues and problems in new and different ways; and also to deal with them by means of using creative, systematic, and analytic strategies. So, it can be inferred that helping students to improve their problem solving skills is one of the most crucial focus points for employability and, increasingly, for education and training at all levels.

Individuals who have already acquired problem solving skills can deal with any problems (that is, either simple or complex ones). Although problem solving skills are essential for each person, they are especially important for certain areas of profession in which aiding of other humans is one of the most prominent ones. In this regard, problem solving skills should be certainly made students to acquire along with the education system. Because, only individuals who are not just taking the information, but rather using it and being able to teach themselves can cope with the rapid increase of knowledge and technology. Also, it has been stated that individuals who can criticize, query, and solve the problems creatively will be effective in societal development, as well (Güzel, 2004; Berkant and Eren, 2013).

According to Genç (2012), there are two substantial reasons for concerning about problem solving in science education. Firstly, there is a common assumption that a student who solves a science problem with the guidance of a teacher might learn the subject more effectively than others. By considering that assumption as correct, we teach many science-related subjects through problem solving; so, problem solving is a teaching method. Secondly, there is another assumption that problem solving skills can be learned and be transferred to new situations after learning. Again by considering that assumption as correct, we include problems with the aim of not only teaching the subject content, but also teaching the problem solving methods. Thereby, among the general purposes of science education, the duty of a teacher is to make students solve their problems by means of science, comprehend the cause-effect relationship of occasions and facts, acquire a consciousness of proper scientific judgment (i.e. by questioning it) related to encountered occasions, and learn to use their own minds, have the habit of studying regularly and systematically, and learn how mankind can adapt to the changes of nature (Temizyürek, 2003).

From the point of teachers, teaching science is a process of questioning, as well, in which the teachers' own ability to develop problem-solving skills matter. Thus, teachers, just like students, need training on how to use

problem solving skills before they start to use any method including the use of problem solving skills effectively. In other words, teachers in science education may have a concern about the slow development of problem-solving as a teaching method due to the fact that there is a lack of experience in teachers' training in the current issue (Andersen and Weigand, 1967).

Briscoe and Stout (1996) indicated that teacher-educators can prepare teacher candidates more likely to engage in teaching through problem-solving by means of providing various experiences in problem-solving in which the processes and content for mathematics and science are fully integrated and essential for solving the problems. Therefore, the problem-centered learning activities should allow opportunities for pre-service teachers to form and make connections between processes and outcomes of problem solving. Through this way, pre-service teachers can be trained for considering the teaching of problem solving skills as one of the most effective ways. Similarly, a method of integrating problem-solving to the class experiences is an essential factor which might lead to the preparation of more efficient elementary teachers. However, it is important to note that the future practices of prospective teachers who are able to implement problem solving strategies in their classrooms will be affected by a number of factors including the culture that they work in, the contexts of their classrooms, and the frameworks of their own beliefs about problem solving (Briscoe and Stout, 1996).

According to the literature review, pre-service teachers were investigated by many aspects and variables of problem solving skills such as age, sex, graduated high school, university, department, reasons for choosing that department, specific area they are working on (for example, social, science), grade level, parental education status and occupations, and accommodation while receiving education (Arslan, 2001; Ocak and Eğmir, 2014; Aslan and Uluçınar-Sağır, 2012; Üstündağ and Beşoluk, 2012; Çevik and Özmaden, 2013; Akpınar, 2014; Kuloğlu and Arı, 2014; Karabacak et al., 2015).

According to the findings of experimental studies related to the factors affecting the perception levels of pre-service teachers regarding problem solving skills; learning based on a creative thinking in science education improves pre-service teachers' problem solving levels (Koray, 2003); science education based on a constructivist approach is more successful in developing problem solving skills in pre-service teachers compared to traditional education methods (Orhan, 2004); science education grounding on critical thinking skills is more effective in improving the problem solving skills of pre-service teachers compared to traditional education (Yıldırım and Yalçın, 2008).

Studies in the current literature demonstrate that

problem solving skills of pre-service teachers may differ with respect to some variables. Also, it has been indicated that learning environments provided to pre-service teachers might make differences in their perceptions related to their problem solving skills in a positive way. Therefore, rather than their demographic variables that cannot be made any changes on, it is important to focus on programs that are implemented in learning-teaching process, due to the fact that those programs are already proved as being effective on pre-service teachers' problem solving skills. Overall, it can be concluded that, making prospective teachers acquire problem solving skills during their own education will have an important effect on the future of a country. That is to say, it is essential to teach them acquiring their own problem solving skills in order to ensure that they will help their students in this issue (that is, by leading them to internalize that skill, above and beyond just giving the necessary information to solve problems).

The present study focuses on changing pre-service science teachers' perceptions about their own problem solving skills through a 4-year teacher education program. Examining the pre-service teachers' beliefs on this issue is expected to provide a broader definition for potential teacher education programs. It is also expected that understanding the effects of methods acting on pre-service teachers will be useful as being a model for other teacher educators. From another point of view, this study is designed to investigate the development and changes in problem solving skills of pre-service science teachers of the Primary Science Teacher Education Program (PSTEP) in Pamukkale University in Turkey over the four-semester-sequence. The following main question was presented:

Problem solving skills of pre-service science teachers make a meaningful difference in terms of class level change? (Problem Solving Skills are examined by considering the following subscales:

1. Impulsive style (IS)
2. Reflective style (RS)
3. Avoidant style (AS)
4. Monitoring (M)
5. Problem-solving confidence (PSC)
6. Planfulness (P)

METHODOLOGY

This research uses simple descriptive survey approach which is a one-shot survey for the goal of describing the characteristics of a sample at one point in time rather than the cross-sectional and longitudinal approaches of survey research (Mertens, 1998). In this research, how a four-semester-sequence teacher education program helps to change pre-service teachers' perceptions about

their problem solving skills was described.

Sample of research

Participants of the current study are pre-service science teachers of a faculty of education from a state university in one of the cities located in the west of Turkey.

Purposive sampling was used for selecting the participants. In this procedure, it is assumed that selected participants have the necessary information about the target population (Frankel and Wallen, 1996).

In total, 343 pre-service science teachers (that is, 76 freshmen, 81 sophomores, 117 juniors and 69 seniors) who study in the Department of Science Teacher Education in 2012 to 2013 academic years participated in this study. 76 first year pre-service science teachers have enrolled in basic science courses (Physics I-II, Chemistry I-II and Mathematics I-II).

At this level, they have taken the courses, namely introduction to educational science and educational psychology. 81 second year pre-service science teachers enrolled in basic science courses (Physics III-IV, Chemistry III-IV and Biology I-II) in addition to introductory courses on science teaching, namely Science-Technology Programme and Planning. It is assumed that 3rd year of this program has an essential role in science-teacher education due to the fact that this is the year in which pre-service science teachers complete the sets of basic science courses (Physics I-II-III-IV, Chemistry I-II-III-IV, Mathematics I-II and Biology I-II); and besides, they take courses on science teaching (for example, Special Methods of Science teaching I), science laboratory practices (that is, Science Teaching Laboratory Practices I-II) and nature of science (that is, Nature and History of Science).

Lastly, the 4th year of pre-service teachers in this program includes courses related to science teaching (that is, Special Methods of Science Teaching II), school experiences, teaching practices, Turkish educational system and school management.

Data collection tools

Problem solving inventory (PSI; Heppner and Petersen, 1982) was used as a measurement tool in this study. Heppner and Petersen (1982) suggested that the PSI is designed to measure some constructs; namely,

1. Amenable to change through specific skill training in problem solving
2. Unrelated to conceptualizing means to hypothetical problem situation
3. Related to subjects' general perceptions of their problem solving skills
4. Unrelated to intelligence or social desirability, and
5. Related to personality variables (most notably locus of control). PSI was adapted into Turkish by Şahin, Şahin and Hepner (1993) (Problem Çözme Envanteri,1993), and it consists of 35 items including both positive and negative statements. It is based on a 6-point Likert scale. Reliability analysis of the adaptation into Turkish was also conducted by Şahin et al. (1993) by means of the participation of 244 university students. As a result of that reliability study, Cronbach's alpha coefficient was found as 0.88.

In this study, Cronbach's Alpha coefficient was found as 0.86. Şahin et al. (1993) indicated that this scale consists of 6 dimensions which are Impulsive Style (items 13, 14, 15, 17, 21, 25, 26, 30, and 32), reflective style (items 18, 20, 31, 33, and 35), avoidant style (items 1, 2, 3, and 4), monitoring (items 6, 7, and 8), problem-solving confidence (items 5, 11, 23, 24, 27, 28, and 34) and planfulness (items 10, 12, 16, and 19). These approaches specifically measure the following components:

Impulsive STYLE

While solving a problem, whether an individual approaches the problem in a hasty and impulsive way, a sample item is "When confronted with a problem, I tend to do the first thing that I can think of to solve it.".

Reflective style

While facing a problem, whether the individual tries to understand the situation, whether he/she reviews it, or considers all the related information to solve it. A sample item is "When making a decision, I weigh the consequences of each alternative and compare them with each other."

Avoidant style

Whether the individual broadly thinks about information gathering to solve the problem, whether he/she has suspicions about dealing with the problem in case of he/she fails or encounters some obstacles while solving it, and whether he/she thinks about problem solving procedure (that is, what worked and/or what did not work) after the problem has been solved. A sample item is "When a solution to a problem was unsuccessful, I do not examine why it didn't work."

Monitoring

While facing a problem, whether the individual presents more reasons about the problem and evaluates it from the multidimensional perspective. A sample item is "When I have a problem, I think up as many ways to handle it as I can until I can't come up with any more ideas."

Problem-solving confidence

Believing in oneself or feeling qualified to solve a problem. A sample item is "I trust my ability to solve new and difficult problems.".

Planfulness

While solving a problem, whether the individual plans the solution by forming the steps of a problem, a sample item is "I make decisions and am happy with them later."

Data analysis

The collected data was analyzed by using statistical package for social sciences (SPSS) (Version 20.0). In the scoring, negative items were reversed. For the scoring of the scale, items 9, 22, and 29 were extracted from the scoring. Reverse items were 1, 2, 3, 4, 11, 13, 14, 15, 17, 21, 25, 26, 30, and 34.

Total score that can be obtained from the scale was between 32 and 192 points. In order to determine the average total point obtained from inventory and sub-dimensions, descriptive statistical methods were used. In order to determine whether data is normally distributed, Kolmogorov-Smirnov analysis was ran and analysis showed a normal distribution (K-S(Z)=1,168; $p > 0.05$). One-way ANOVA was performed in order to examine whether there is a significant difference between problem solving skills and grade levels.

Table 1. Findings of one way ANOVA indicating the perception of problem solving skills scores in terms of grade levels.

PSI	Grade Level	N	$\overline{X}$	SS	F	p	Significance (Tukey HSD)
PSI total	Freshmen	76	87.1316	18.5518	4.632	0.003*	2-3*
	Sophomore	81	89.3827	19.1250			2-4*
	Junior	117	81.4103	15.5852			
	Senior	69	81.3043	17.6304			

* $p < 0.05$.

Interpretation of data

The height of obtained points from the scale indicated that pre-service science teachers' perceptions about their own problem solving skills were "unsatisfying". In addition, perceived low points indicated positive perception about their problem solving skills, effectiveness in problem solving, and behaviors and attitudes about the successful problem solving (Şahin et al., 1993). On the other hand, in the scoring of subscales measuring problem solving approaches which are characterized as positive-desirable (that is, reflective style, problem-solving confidence, monitoring, and planfulness), low points indicated more usage of these approaches. On the contrary, the less scores on problem solving approaches which are characterized as negative-ineffective (that is, impulsive style and avoidant style) indicated the less usage of those approaches.

RESULTS

One-way ANOVA was performed in order to investigate whether there is a significant difference between problem solving inventory (PSI) scores and the grade levels of pre-service teachers who participated in this study (Table 1).

As shown in Table 1, there is a significant difference between PSI scores and grade levels of pre-service science teachers ($F = 4,632$; $p < 0.05$). In order to determine the direction of this difference based on the grade levels, the multiple comparison analysis, namely Tukey HSD analysis, was conducted.

The findings of this analysis indicated that sophomore pre-service science teachers are significantly different from both junior and senior pre-service science teachers ($p < 0.05$). While investigating the average total scores based on the grade levels, average total scores that sophomore pre-service science teachers have obtained from PSI (89,382) are lower than both junior (81,410) and senior (81,304) pre-service science teachers' average scores. When considering the fact that individuals who obtained higher scores form the inventory have insufficient problem solving skills, it can be concluded that sophomore pre-service science teachers' perceptions about their problem solving skills are lower compared to that of junior and senior pre-service science teachers. Table 2, on the other hand, indicates the

findings of One-way ANOVA which was conducted to investigate the sub-dimensions of Problem Solving Inventory based on the grade levels of pre-service science teachers.

In Table 2, there is no significant difference between the Reflective, Monitoring, Problem-Solving Confidence, and Planfulness sub-dimensions of PSI based on the grade levels of pre-service science teachers ($p > 0.05$); whereas a significant difference was detected for Avoidant and Impulsive sub-dimensions of PSI ($p < 0.05$). In order to determine the direction of this difference based on the grade levels, the Tukey HSD Post Hoc analysis was conducted. The findings of this analysis indicated that in terms of the Impulsive Style sub-dimension, sophomore pre-service science teachers are significantly different from both junior and senior pre-service science teachers. Moreover, in terms of the Avoidant Style sub-dimension, freshmen pre-service science teachers are significantly different from both junior and senior pre-service science teachers. While investigating the average sub-dimension scores based on the grade levels, in the Impulsive Style sub-dimension of PSI, sophomore pre-service science teachers (3.322) have higher average scores compared to both junior (2.987) and senior (2.989) pre-service science teachers' average scores. Thereby, it has been concluded that sophomore pre-service science teachers use impulsive approach styles more than junior and senior pre-service science teachers. On the other hand, in the Avoidant Style sub-dimension of PSI, freshmen pre-service science teachers (2,592) present more avoidant approach styles compared to junior (2.199) and senior (2.141) pre-service science teachers.

DISCUSSION

Today, with improvements in knowledge, science, and technology have posed problems to some individuals trying to adjust to the new situations. Accordingly, in order to make them cope with those problems, the issue of improving their problem solving skills becomes one of the most important purposes of education. Therefore, training the new generations who are supposed to shape

Table 2. Findings of one way ANOVA indicating the Subdimensions of problem solving inventory in terms of grade levels.

PSI Sub-dimensions	Source of variance	$\bar{X}$ N		SS	F	P	Significance (Tukey HSD)
Impulsive	Freshmen	76	3.161	0.703			
	Sophomore	81	3.322	0.738	5.240	0.002*	2-3*; 2-4*
	Junior	117	2.987	0.563			
	Senior	69	2.989	0.614			
Reflective	Freshmen	76	2.363	0.795			
	Sophomore	81	2.548	0.964	1.462	1.225	-
	Junior	117	2.313	0.736			
	Senior	69	2.339	0.797			
Avoidant	Freshmen	76	2.592	0.972			
	Sophomore	81	2.500	0.919	5.236	0.002*	1-3*; 1-4*
	Junior	117	2.199	0.801			
	Senior	69	2.141	0.814			
Monitoring	Freshmen	76	2.575	1.015			
	Sophomore	81	2.543	1.025	0.291	0.832	-
	Junior	117	2.516	0.766			
	Senior	69	2.387	0.890			
Problem-solving confidence	Freshmen	76	2.611	0.863			
	Sophomore	81	2.721	0.832	2.107	0.099	-
	Junior	117	2.464	0.604			
	Senior	69	2.501	0.771			
Planfulness	Freshmen	76	2.625	1.028			
	Sophomore	81	2.515	0.916	2.306	0.077	-
	Junior	117	2.344	0.690			
	Senior	69	2.330	0.788			

* $p < 0.05$.

the future as individuals having problem solving skills in both education process and daily life is an essential goal for all the education levels. So that, newly applied education programs since 2004 in Turkey have a target to develop students' problem solving skills (MEB, 2013).

Enhanced problem solving skills make students more powerful both in their educational and professional live, in addition to their private lives according to the Centre for Good Governance (CGG). Both nationally and internationally, there is a growing consciousness that problem solving skills will be much more important compared to the past if education system aspires to produce skilled thinkers and innovators in the current fast-changing global economy. To be able to solve problems in a range of learning contexts, the development of knowledge, understanding and performance is very important. To make students engage in complicated and authentic problem solving encourages them to use content knowledge in more innovative and creative ways which in turn intensifies their deeper understanding (GIHE, 2011).

It is important to note that effective problem solving skills rarely rise spontaneously; instead, they are consciously learned and nurtured. Specifically, effective problem solving skills are conceptualized as developing creative, innovative, and practical solutions, showing independence and initiative in identifying problems and solving them, and applying different strategies to solve the problem across a range of areas (CGG, 2006).

In this study, pre-service science teachers' problem

solving skills were evaluated in terms of their problem solving skills' scores and grade levels. Also, perceptions about their own problem solving skills were investigated through the several subscales, namely Impulsive Style, Reflective Style, Avoidant Style, Monitoring, Problem-Solving Confidence, and Planfulness.

According to the findings of the current study, there is a significant difference between pre-service science teachers' problem solving skills in terms of their grade levels. Accordingly, whereas the averages of pre-service science teachers' problem solving skills ranged through the lowest to the highest for juniors, seniors, freshmen, and sophomores, respectively; it has been determined that junior pre-service science teachers have the highest, and sophomore pre-service science teachers have the lowest problem solving skill perceptions due to the fact that low scores obtained from the scale indicate high problem solving skills.

This finding can be interpreted as courses such as Scientific Research Methods and Science Laboratory in the third year of science teacher education program are effective in terms of their contents and applications towards improving students' problem solving skills. Such methods as problem solving at laboratory, which place students in the center of learning, encourage asking more questions, inquiring and researching, promote suggestion of solution methods and enable them to take the responsibility of their own learning through designing an experiment, are favorable (Güngör-Seyhan, 2014).

Also Aslan and Uluçınar (2012) concluded that pre-service science teachers' problem solving skills are better at the first and fourth grade levels compared to the second and third ones. On the other hand, Yenice (2012) determined that senior pre-service teachers are better compared to both freshmen and juniors. This finding shows that this situation originates from the difference between the sample and teaching fellows.

In the current study, the only significant difference is found between Impulsive Style and Avoidant Style based on the grade levels, when pre-service science teachers' perceptions towards their problem solving skills were investigated through the approaches of Impulsive, Reflective, Avoidant, Monitoring, Problem-Solving Confidence, and Planfulness.

As the scores obtained from the Impulsive and Avoidant subscales (which can be characterized as negative-ineffective) among the problem solving approach methods decrease, it is thought that the usage of those approach methods diminishes. Specifically, Impulsive Style reveals whether an individual approaches the problem in a hasty and impulsive way while solving a problem. It includes whether an individual goes for the first idea that comes to the mind without rethinking when faced with a problem; whether he/she considers different factors about the problem; and overlooks most things when tackling problem. Thereby, approaching the problem impulsively may lead an individual to make mistakes in problem solving (Birel, 2012; Erdoğmuş, 2004).

In this context, according to the findings of this study, sophomore pre-service teachers use more impulsive approach compared to juniors and seniors; so that they tend to make a mistake on problem solving more than others. Avoidant Style, on the other hand, assesses whether an individual think about information collection related to problem solving in detail; whether he/she begins to suspect the way he/she tackles problem in case he/she fails; and whether the individual thinks about what works and what does not after the problem has been solved. The behavior of withdrawal that an individual display in solving problem is directly related not to try to solve problem. One of the reasons behind avoiding problem might be the feeling of self-incompetence (Birel, 2012; Erdoğmuş, 2004).

In this context, under the light of the findings of the present study, it can be stated that freshmen pre-service science teachers tend to adopt far more avoidant approach compared to juniors and seniors. Üstündağ and Beşoluk (2012) found that senior pre-service science teachers' usage of "Avoidant Style" is significantly higher than that of juniors, while investigating the relationship between the sub-dimensions of total scores that pre-service science teachers obtained from that scale and their grade levels.

The findings of this study also showed that there is no significant difference between pre-service science teachers' perceptions towards their problem solving skills in the Reflective Style, Monitoring, Problem-Solving Confidence, and Planfulness and their grade levels. In the scoring of sub-dimensions, it is evaluated that as the scores of sub-dimensions assessing problem solving approach methods which can be interpreted as positive-desirable (that is, reflective style, problem-solving confidence, monitoring, and planfulness) decrease, the usage of those approach methods increases.

Overall, no matter what pre-service science teachers' grade level is, it can be concluded that they try to understand the situation when facing a problem, review, consider all the information related to the subject, compare and contrast the consequences of different choices while trying to decide the problem solving method, and thereby struggle to reach the best result in problem solving necessarily through *thinking*. Also, they compare the solutions which are obtained after trying a certain method and the solution that they think of it, try to think about all the ways to apply in order to solve the problem. Thereby, they put forth more reasons, *evaluate* the problem from a multi-dimensional perspective, are able to reach healthier solution, and they consider themselves as sufficient for problem solving and try to

solve the problem, they *trust* themselves, plan through constructing the problem steps in order to solve the problem, and finally they reach the solution through evaluating the obtained data in a planned way.

Conflicts of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Freirian perspectives on becoming female researcher-academics in special education

Amelia Medina Rau[*], Randa G. Burks-Keeley, Leslie Costa-Guerra and Amal Ibrahim

New Mexico State University, Mexico.

Perhaps the most influential thinker about education in the late twentieth century is Paulo Freire. He has been particularly popular with informal educators with his emphasis on dialogue. According to Freire, to enter into dialogue presupposes equality amongst participants. Each must trust the others; there must be mutual respect and love (care and commitment). Each one must question what he or she knows and realizes that through dialogue existing thoughts will change and new knowledge will be created. This study highlights the diversity of life and professional experiences of one doctoral cohort at New Mexico State University in Special Education. We reflect on topics of gender, culture, and language by reflecting on the impact of individual backgrounds on our collaborative intent to build a doctoral learning community.

Key words: Gender, language, culture, education, experience.

INTRODUCTION

Since the birth of academia gender, culture, and language have played a large role in the hierarchy of higher education. Contributing to this hierarchy could be that two thirds of all illiterates in the world, approximately 565 million people, are women (Finke, 1993). In the field of education, females are the dominate fixtures at the primary and elementary level; however, the comparison between men and women drastically changes as the level of school increases.

At the secondary and higher education levels, men easily overtake women in their numbers (Staudt, 1998). The most significant gaps in gendered education occur at the secondary level in which females are rarely encouraged to study in fields of science, math, or technology; contrastingly, females are often found studying in the fields of humanities, service, and commerce (Staudt, 1998). Segregations among males and females in the aforementioned mentioned fields of study contribute to post higher education outcomes. This logic does not follow that of a modern female.

Paulo Freire, perhaps the most influential thinker about education in the late twentieth century, suggests that "the integration of the younger generation into the logic of the present system" is not only necessary, but imperative to ensure a future which would allow for the "practice of freedom" (Freire, 1968). Freire's "practice of freedom" and "dialogue" is the enabling of students to become activists for the transformation of the current system (1968). According to Freire, to enter into dialogue presupposes equality amongst participants. Each must

*Corresponding author. E-mail: a_medina@nmsu.edu.

trust the others; there must be mutual respect and love (care and commitment). Each one must question what he or she knows and realizes that through dialogue, existing thoughts will change and new knowledge will be created.

Student who learn English as a second language are not lazy, unprepared, and passive, there are some reasons preventing them from participation in the class such as shyness, culture, power, their backgrounds, and not feel entitled to participate in the class (Vandrick, 2000).

Culture is a way of life that include knowledge, laws, attitudes beliefs, mores, customs, language traditions, habits, achievement, spiritually, thoughts mores, values, customs, religion and rules which allow interactions and communications with group of people in the society. The interaction among the members of society may accrue through the use of language through using verbal or non verbal which is considered as the vehicle of culture (Ogunsiji et al., 2012).

This study highlights the diversity of life and professional experiences of one doctoral cohort at New Mexico State University in Special Education. We reflect on topics of gender, culture, and language by reflecting on the impact of individual backgrounds on our collaborative intent to build a doctoral learning community.

The Freirian background

Born in 1921 in Northeastern Brazil to middle class parents, the young Paulo Freire began life as privileged. That was, until the economic crisis of the 1930s Great Depression in the United States radiated onto a precariously underdeveloped Latin America. Like much of the population, Freire too came to experience a "culture of silence" and hungering poverty that so poignantly motivated his viewpoints and manifesto-like pieces of educational and political philosophy. Devoted to advancing those who were marginalized, Freire dedicated himself to a "pedagogy" of enabling the oppressed of the world. The following will attempt to summarize historical context, and some of the main concepts of the singular "Pedagogy of the Oppressed," including our emphasis on Freirian dialogue as tool for building a doctoral learning community.

Historical contexts

It was during the 1964 Brazilian government coup d'estate, the first of many in Latin America, that a violent political take-over forced Paulo Freire into exile in Chile, a country itself not far from dictatorship. There he worked for the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and later traveled to the United States before returning to his homeland. Some of

his counterparts, other targeted pubic figures in denouncing militant dictatorships, would become martyrs like Chilean Victor Jara. Other exiled compatriots, like Caetano Velsoso, a musician also from Bahia, Brazil, would travel and live in the underdeveloped "third" world but in the philosophical realms of European society. The exile fueled Freire to develop a philosophy of the education for the marginalized, oppressed, silenced, illiterate, adult, and so-called ignorant. He believed that all are capable of critically encountering their reality, in both personal and social situations, when given the proper tools. Pulling from philosophers such as Ortega and Gasset, Unamuno, Martin Luther King, and Che Guevara, the philosophy then also became politically volatile and such an actual threat to established order that he would be exiled for attempting to empower the impoverished, disinherited, and illiterate masses to carefully look at their situation and towards participation. In the United States, these Latin American masses can be likened to those outside the dominant Euro-American culture, i.e. immigrant and minority populations that have also been historically displaced in their citizenry.

Implications for education

Perhaps one of the main Freirian conclusions for us universally is that the educational system itself is the major policy setter and instrument in perpetuating a "culture of silence" so often mentioned throughout his work. This "new" education proposed by Freire instead lends itself to novel experiences of reality, self, and dignity to transform worldviews and deprogram cultural conformity into radical self-awareness as a non-static, non-given world needing humanitarian problem solving. Man's ontological vocation is thus to be a subject acting on and changing the world. Freire also describes the oppositional "banking" style of education, in which teachers are the supposed know-all and end-alls who deposit information into students. Instead, Freire calls for authenticity in a model of pedagogical thought, communication, participation, responsibility, and freedom.

Applications in special education

When considering the ever-dominant dependence on the Western model of education, Freirian perspectives have reminded us to revisit our own automated approaches to our dynamic roles in becoming researcher-academics in the field Special Education. The Freirian "practice of freedom," despite its original Portuguese and historical context, hits close to the heart and mission of special educators in the long-standing battle for societal inclusion of those with disabilities.

Perspectives on disability

The definitions of disability have varied widely in the United States and abroad due to changes in societal and educational perspectives across the years, especially during the last century. The traditional deficit view of disability has been particularly marginalizing and is based on early drives in educational measurement in the 1900s to capture the average man's traits and capabilities. Over time, more contextualized views of disability have emerged to compete with the typical vs. atypical nature of deficit perspective. For example, a cultural perspective recognizes the meaning, and degree of handicap due to disability in terms of one's culture. Even more progressive in terms of equality for all, and fitting with Freirian philosophy, is the sociological perspective which suggests it is society who collectively constructs notions of disability and subsequent barriers (Smith and Tyler, 2010).

In the case of the United States, the decision of Brown vs. Board of Education, 1954, paired with the sociopolitical climate of its time, assisted in bringing the Civil Rights movement to fruition for a variety of minority groups. Americans quickly found the will to challenge the government en masse; sit-ins, protests and many more issues of equality came about after schools were desegregated. This landmark case, given special importance by Smith and Tyler (2010: 12), reaches especially deep into our legal promises for fair and appropriate services for all children. The first civil rights law for people with disabilities comes from Section 504 of the Rehabilitation Act of 1973 and was followed years later by the Americans with Disabilities Act (ADA) 1990 (Shapiro, 1994). These laws specifically ensured that people with disabilities could not be discriminated against because of their disability (Shapiro, 1994). Later, the authorization of the Individuals with Disabilities Education Act (1990), formerly Education of All Handicapped Children Act (1975), and reauthorized most recently in 2004 provides a free and appropriate education for all students with disabilities (Shapiro, 1994). Thus, over the last fifty years, cultural diversity and the need for cultural competency has taken a foremost role in the preparation of pre-service and in-service professionals in the field.

Growing diversity

Acknowledging a rapid racial and ethnic diversification in the United States, special educators have begun to pay more attention to promoting culturally relevant practices to better serve students from culturally and linguistically diverse (CLD) backgrounds. That being said, however, past and current research reveals an over-representation of minorities being placed in special education programs (Donovan and Cross, 2002), requiring continued advocacy for CLD assessment and intervention reform.

While the intended audience of Freirian pedagogies was specifically the earlier mentioned community of educators and humanists at a time in Latin America when Socialism was on the verge of possibility, due to the reality of the now audience, ourselves as students, it must also be that the work of Freire is applicable to the situations of the doctoral education. This includes, but is not limited to, the realms of special education scholarship and leadership acting on behalf of diverse populations to fight against oppression of groups historically labeled as "inferior" and provide tools, specifically for those called "disabled" to participate and transform their situation.

Our becoming and dialogue

The reader and student of Freire's methodology must react openly and actively, since liberation is not passive. The truths of those willing towards radicalism, and "unveiled reality" are the only trustworthy actors of these goals. What Freire deemed *conscientizacão* in his native Portuguese, is learning to perceive social, political, and economic contradictions and then taking action against the oppressive elements of that reality. Therefore, the approach must be a dialogical and problem solving education. The "dialogue" suggested must prove then to be a commitment to a mutual trust and faith in humanity, such that thematic investigations are anthropological and cultural concepts rather than dehumanizing.

The justification for such an education stems from those truly involved with a concern for humanity, so much so that the recognition of dehumanization is unavoidable. This dehumanization includes acts of injustice, exploitation, oppression, violence, labor, alienation, rape, struggle and so forth. Freire denounces this historically structured discourse of conquest, manipulation, and cultural invasion that has preserved certain dominations and status quos over time. Again, the alternative and necessary is a theory of action and communication, the *conscientizacão* of the oppressed. To overcome the *conscientizacão* a clear and resounding voice must be present.

Giroux (1988) refers to voice as "the means at our disposal−the discourses available to us−to make ourselves understood and listened to". As women in academia our voice must be discovered and listened to. In the United Kingdom, the percentage of female professors stands at 15.3% and in Germany women represent a mere 8.6% of professors (Pritchard, 2007). It is suggested that women carry the 'curse' of caring and that students have a certain expectation for women professors that requires the adaptation of a feminine style of teaching (Carson, 2001). Therefore, women in higher education are required to work harder to overcome their 'curse' and meet not only the research standards, but also that of teaching and counseling (Carson, 2001).

Instead of neutralizing of our gender roles, we view the road to true equality and intellectual freedom for academic women within the context of oppression.

Interestingly, Freire outlines the contradiction of the oppressed and the oppressors, obvious to him in the historic setting of his writing that as the first step of self-awareness begins there is surprising effect of "fear of freedom," in which the oppressed begin to actually adhere to the modeled attitude of oppressive power which has already been internalized as the only gaining group, precisely materialistic in its purpose despite the cost to the "other" as a human given right (Freire, 1968). Since the oppressed are emotionally dependent, Freire claim their behaviors actually prove "necrophilic" or self- and fellow- destructive. While obvious efforts are being made in academia to move to a better appreciate of the scholarship of teaching, the publish or perish mentality still exists (Boyer, 1990).

The cutthroat nature of academia is ever present with regard to research ideas and publications. Rather than an outpouring of continuous research knowledge, academics are holding on to manuscripts and research so as to submit for publication at a time that will most benefit their career. Liberation then must be mutual for both the oppressed and it's oppressors to destroy false charity, greed, and dehumanization, to create a revolutionary leadership that practices, "co-intentional education". Freire describes that, "teachers and students (leadership and people), co-intent on reality, are both subjects, not only in the task of unveiling that reality... [but also] through common reflection and action" (p.51). To us, this last thought of co-intention with dialogue is the most fundamental to what we would also call cooperation, being the only means for equality en masse.

In his book, *Teachers As Cultural Workers*, Freire describes the notions of understanding oneself by stating, "the importance of identity of each one of us as an agent, educator or learner, of the educational practice is clear, as is the importance of our identity as a product of a tension-filled relationship between what we inherit and what we acquire" (p.125). According to Freire, we interact with our world based on our identity, and our identities are formed through dialogue and discourse. As a part of dialogue and discourse in learning and communicating, comes the importance of individual stories. Individual stories guide how each person view his or her world, especially when interacting in the education arena.

METHODOLOGY

The authors used descriptive research in their study based on their own personal experiences reflected on topics of gender, culture and language. Four participants were participated in this study, their age between 30 and 40, came from different backgrounds.

Research question

This research is attempting to answer the below questions:

Does getting higher education affect women from different background positively reflected on topics of gender, culture, and language?
What are the affects of getting higher education in women life from different backgrounds?

Our stories

Culture

Leslie: *According to Freire (2005), as cultural workers, educators must be able to know and understand their own ideals. For me, this involves understanding my foundation for researching and approaching scholarly endeavors. My life as a cultural being, a woman and an educator means that many of my lines cross, but none of these lines hide my core.*

I never knew that I was biracial, until someone told me that I was a "half-breed". Growing up while being both Hispanic and Native American was not an hindrance, and in fact, my background was a blessing. I have never felt like I was living in two worlds, but instead like I was living in one world with many opportunities to view that world differently. The difficulty for me was never discovering who I was as an individual, but the difficulty lies with where I fit in academia.

When I decided to get my PhD, I knew there would be challenges, but what I did not expect was that the challenges would be mainly in terms of inner struggles. We learn so much about paradigms in college and how these schemata help shape how we approach research and learning. This notion of paradigms is where I found myself pondering possibilities as a minority woman. I do not find myself shifting paradigms. I only find myself building and removing from the paradigms I already have. The biggest building block for me was not in terms of methodology or frameworks for research, but instead was the paradigm of my own credence of seeing the world, which was static and dynamic at the same time. Why do I have to choose one way of thinking when my whole life I have been blending different ideologies? Along with blending ways of thinking comes the ability to blend roles.

Amal: *In general, women in developing countries live in almost the same situation, in terms of their role in the family compared to men, for example when there is limited resources for the family in deciding between a male and femal, the male is still preferred to get his chance to continue his higher education - because he is a man - and the woman has to sacrifice for her brother - because she is a woman.*

Historically, women were taught the skills of fine

weaving, and the preparation of food and taking care of their families where men go to work, hunting, and provide the protection for the tribe. During the Turkish conquest, this concept was consolidated, but after the independence in 1946 the first signs of any Government concern to promote women's education were seen in the 1967 after establishing the first university in Jordan. After women were given new roles in the society, the ideas grew and matured, but very slowly, and start to speed up after the 2000s.

In addition to the cultural components we are raised in within our societies, also as international student in the US we are dealing with different ideologies and multicultural community which puts us in a situation where we don't know what is acceptable and what is not acceptable in this new environment. For example, graduate and undergraduate students in my country are not allowed to eat in class, leave the class room without reason, or use laptop during the class time. But in the US universities, students can do all these things. In my culture it is considered as disrespect.

During the first time I get involved in classes with American students I got the feeling that American classmates have the tendency to see American culture as superior to other cultures and that the American's culture should be the model for others. Because of this feeling, it was hard for me at the beginning to make friends in addition, because of other reasons I did not feel accepted from some people and tended to be evaluated negatively. But after few times I was able to make great friends and I invited them to my house and now they are very supportive of me and my family.

Randa: When I consider for a moment I realize my culture is patrilineal. Through my mother's side I have inherited the Cherokee Indian Tribe of Arkansas and Missouri. I am an inactive tribal member, but if you just look at me you wouldn't believe that statement at all. I am pale skinned and freckled, I don't speak Cherokee, and I have never been to a function related to the tribe, but none-the-less I am Cherokee and I have the credentials to prove it. Now, on my father's side I am considered Irish and my physical characteristics, other than my dark brown hair and brown eyes, reflect as much. Lineage aside, my culture originates in the deep southeast corner of Oklahoma, not Arkansas, not Missouri. My culture consists of fried foods, Baptisms, Sunday dinner at grandma's, fishing and hunting, long endless summers, and an expectation that I will always do the right thing. Way down south in Oklahoma is where my story of culture begins.

Along with culture comes an identity. My identity as an educator began long before I ever conceived of becoming a teacher. My journey begins with the reputation of my educator parents in a small town. I was raised in a small town in the south by educator parents with a stellar

reputation and at an early age I became well aware of the influence teachers have on the lives of their students and the parents of those students. Although as educators my parents made a meager salary they never hesitated when one of their students needed something. There were a number of occasions I remember them providing clothing or shoes to students they knew had none or providing money to students that would otherwise go without. There were times when their former students, now adults with children themselves, would stop by our house in need of money to help make ends meet and never failingly my parents gave. Still to this day former students stop by my parent's home just to say hello or talk to my mom and dad about how they had influenced their life. My parents were agents of change, and still are. They have made a difference in the lives of so many people. Their kindness, fairness, and compassion have transcended the tension-filled issues of education and indeed they leave their mark and legacy behind as they enter the last years of their work as educators.

Therefore, my journey as an educator begins with an inherited culture, identity, and reputation. As an educator I have inherited compassion, fairness, and kindness; I have acquired tenacity, conviction, knowledge, drive, and ambition. When choosing to become an educator I thought of the influence my parents were able to have on the students that they taught, and although I knew they struggled with education and its policies that they made a difference in this world. I too wanted to make a difference and help to correct some of those policies and procedures that had plagued the educational system for so many years.

Amelia: How do I address my White Midwestern English-speaking roots with my acquired Latina and native-like Spanish-speaking second culture? In reality, and despite a couple of decades with this question, I still struggle to reconcile a linear narrative of my bilingual and bicultural identity. Perhaps 'these' complex emotions may be shared by students across the U.S. and across the globe, although without the luxury of an adult emotional capacity. As I approach the topic, are memories of mistaken identity, confidence, anger, pride, guilt, freedom, loss, privilege… all confusing feelings about who, how, and why I am. A defensive voice usually appears trying to make a legitimate argument my name, profession, interests, beliefs, etc. Eventually, I would like to convey the richness of these feelings but also illustrating a picture of a confident professional woman. As a mother, I would also like that by the time my son, Lucas, deals with this, maybe society will not care so much.

Gender

Leslie: My husband recently got his PhD, so I feel like I

am lucky to have an example of what to aspire to because we were told that over 90% of PhD students never finish. I am not just a student, so having this example to guide me is important. Some of my roles in life include: student, wife, mother, instructor, researcher, community member, homemaker, provider and supporter. Within each of these roles I find myself always the same at the core, but I use different tools within each task at hand, just like experiences in developing new ideologies in the doc program. It is impossible to completely change my own views or paradigms depending on my role, but it is possible to adjust the pendulum based on necessity. Through the process of the doctoral program, I have learned to mold academia to myself instead of the other way around. My learning involves knowing my views, my values and myself, and how these ideas mold my creed for life long learning. The best way to explain my experiences in being in a doctoral program and coming from a diverse background is with a metaphor. The doctoral program for me is like a bubble: a delicate balance of science and beauty, changes colors depending on outside influences, and travels along a journey waiting to burst with knowledge. Although this intellectual bubble may seem clear upon first glance, it is complex and lustrous. This bubble can also be deceiving in that it can only be produced with the right combination of elements. This same bubble also allows you to see yourself through all of the complexities, only if you look closely.

Amal: Some people may wonder if women are prohibited to be educated in Islam. To answer this question, we need to understand the role of religion and culture and we must distinguish between the impact of religion and traditions in a woman's right to learn. Islam does not ban women from their right to learn, in contrary, Islam urges all Muslims to learn, and Islam does not separate men from women when urging for education, we obviously see that education is a must for both men and women. In Islamic history we can find many examples of educated women, one of them Ayesha was Prophet Mohammad's wife, and so many others. What some people may see of women banned to get their rights or education in some areas around the world including some Islamic societies. I can guarantee that most of these actions against education women were inherited form generation to generation as part of the culture. For long time, because of poverty and their dependence on agriculture as source of income, men used to provide protection and faring activities and they were responsible of their families. Societies and tribes used to maximize the role of men in societies more than women because of duties they were required to do. Based on that and when there are limited resources to educate family members, the priority was always for men. Now, women in my society have the same right as men in education and no preference for

male over female (DoS, 2010). There is no doubt that women who access the higher education make a great difference for their families and communities as a whole. The education brings additional income women make and can improve family life quality and provide her kids with high quality education and better future. Higher income levels have their right to primary, secondary and higher education.

Randa: My undergraduate college experience was ideal. From the beginning I had little difficulty finding avenues of funding for school and therefore was able to manage a bachelor's degree with zero debt. Trials as an academic came after my bachelor's degree was awarded. It is far from economic to return to school after finishing a bachelor's degree and beginning a career. At this point in life I was married to a teacher and coach and expecting our first child. Therefore, the struggle to obtain an alternate certification in secondary education and master's degree came at an economic and time constraining price. Coincidentally, an alternate certification program was nearby and consequently my certification as a secondary English teacher was obtained through attending night classes for a year while working as a paraprofessional and coach for a small school district. What is less readily advertised is the cost of education at the graduate level. Nonetheless I obtained my certification and received my first teaching assignment in a very small school district in Texas. It was at this school that I discovered the importance of continuing education because it was immediately apparent to me that the field of education was and is littered with problems. I wanted to be an agent of change in an effort to correct some of those problems.

Sometimes I think of my husband as both a blessing and a curse. He is everything anyone could ask for in regards to being a great husband, companion, provider, and father. With that said I will also say that he is very driven and I am very competitive. Anything he attempted gave me the courage and motivation to try as well. So, when my husband decided to return to school for a master's degree, I did as well. He and I both returned to school for a master's degree around the same time. Both of us were full-time teachers and he was a coach as well. He and I sacrificed our salaries and our time with family to become more educated in our fields. He and I received a master's degree in the same year. The experience was exciting and disheartening at the same time. While we had both worked to improve our level of education we discovered that the master's degree had been greatly diluted. Currently, around the country there are master's programs that take less than a year to complete and have vastly reduced standards as compared to our degrees. Yet, these degrees maintained the same weight as our degrees in terms of salary bumps and job qualifications. We knew we both hoped to

continue to obtain a terminal degree, but found ourselves at a crossroads because we could not both attend at the same time as we had with our master's programs.

Through my experiences it has become clear to me that an academic that chooses to continue their education up to their terminal degree in a traditional sense has often put off a marriage and family. I did not, which is why I find myself as a non-traditional doctoral student. This section of our academic struggle I refer to as the doctoral compromise. We knew that while obtaining a doctoral degree each of us wanted to be a full-time student and experience a program fully. Therefore, one of us would continue to work full-time while the other quit a job and went back to school full-time. My husband and I were at a crossroads at this point. Which of us would begin a doctoral program first? After discussions regarding the matter he and I decided that he would return to school while I continued to work. The main reason for this was that he was completely disenchanted with his job as a teacher at this point that he felt he would be miserable if he continued while I knew that education would be the area I would study at the doctoral level and therefore more experience in the classroom would benefit my studies. Our reasoning sounds very practical and responsible, but I can't help but wonder if I gave a small inch to the fight against feminism with that small, but significant decision. I harbor no ill feelings towards him for going back to school first and I feel the pressure he felt by going first has spurred him into becoming the innovative researcher he is today, but as a female I can't help but wonder at myself, why did I do that? And so it was done. He began a program and I became the sup-porting wife, mother, financial support, and cheerleader.

With all honesty, my husband's time spent studying for his doctorate could not have been more beneficial to me. I was able to experience, through him, what it was like to be a full-time doctoral student and how I would need to efficiently manage my time in order to capitalize on the full-time student opportunity. I learned that funding is available to doctoral students for tuition and other items, publishing is very important, time spent at conferences is both educational and an opportunity to network, a dissertation committee can make or break your degree, and many other very important pieces of information. Therefore, when I formally started my doctoral studies as a full-time student I felt more than prepared for the challenges I would face. I did not enter my program blindly. I have seen what it means to complete a program and I know the trials of the dissertation and job search process.

Because my husband went through a program ahead of me I have a new graduate ally that can consistently walk me through issues that arise during my program of study.

Amelia: *As a woman today, society allows me to exist both in family and professionalism, beauty and intelligence. But I do not have true freedom because I am still plagued with self-comparison about gaining status in the academic workplace and doubts about my duties as a mother. Science is supposed to be a humanistic and creative endeavor. To me, this is part of my nature, my gender. But science is to be skeptical, held up to scrutiny, falsifiable, rigorous, and replicable. The battle, I believe, is in adding strength to feminine innovation and humanism to prove ourselves as part of the range of what is a scientist vs. the typical stereotype of the older Caucasian man wearing a lab coat with glasses and working with test tubes. Sometimes, there is an overt message to keep one's multiple roles as woman distant (mother, daughter, partner, friend). In a still too male-dominated world, women are made to see each other as enemies. The goal is that gradually we can share together as fellow intellectuals, friends, and confidents of the same social group and the same generation, to create a new one.*

Language

Leslie: *Language is me. What I mean to say is that my whole cultural and professional being revolves around language. I grew up around Tewa, Spanish and English. For every feast, cultural activity or family event, all three of my languages were used. Each language wove within the cloth of my upbringing showing the delicate balance of language and identity. When I think, I use my language identities to relate to my world. When I think about my Native side, I think in Tewa because Tewa reveals how I connect to nature. When I think of my Hispanic side, I think of Spanish and how Spanish reveals my passionate side. When I think of English, I think about my professional side and how being a Speech-Language Pathologist means understanding that language is key in cultural reciprocity. I cannot imagine my world without having these languages in my life. Without one piece of my language repertoire, I would not be a whole being. There are times in my doctoral program that I find myself searching for which language represents the task at hand. Although most of the time I relate to English, I also have come to realization that I can use my cultural and passionate sides by incorporating my other languages. Language to me is like a beaded design: my languages are different colors and used to show different brilliance, but all of the beads make an aesthetic picture that is me. I am proud to be diverse and feel as though my spectrum of colorful languages only enhance my ability to succeed in life.*

Amal: *When I came to the US in 2007. I knew few English words, but I worked hard to improve my English through English classes in the Dona Ana Community College. Also through reading and listening to English*

speakers. After that I did the TOEFL exam to apply to the master program in EMD. It was hard at the beginning to be in class where everyone speaks in English (different accent). In this regards I can say that the silence that most international student have in classes does not usually mean they are not knowledgeable with the topic they are studying; indeed, it is the language issue. This is what I can tell based on my personal experience. Sometime I got a feeling that my discussion will add nothing in the class, or I may don't have the right words to express my ideas which may be understood differently. Many of my friends came from the same background as me and faced the same problems, especially the first semester they arrived to the US, unless the person lived before in the US and they knew about the language and the culture.

Because most international students have less-than-standard oral English ability this influences their effort within group projects and during presentations. Preparing a presentation is not an easy task, because it makes me worry if I can express my ideas correctly. But after the first or the second semester I have begun to speak up in class a little bit because I dislike feeling isolated and being considered incompetent anymore, also I became more confident to present my work to the class.

Randa: *As mentioned earlier I hail from a small town in the south, southeast Oklahoma to be precise. With that origin in mind, in all of my travels I bring with me a souvenir, one that is always with me and never goes away, an accent. Now, there are many things assumed about me because of the twang in my speech, as some people like to call it, some are negative and some positive. I believe that some people initially believe that I couldn't possibly be intelligent because of this accent, some people associate a certain level of compassion and good manners with the accent as well, and some people just consider it a novelty for entertainment purposes. Nonetheless I am certainly considered an obvious outsider once my mouth opens at any place in the country other than a small region near and around where I was raised. It is the otherness that my accent causes that, at times, creates a problem. There have been situations where I have been less readily accepted because I was obviously not from around there, wherever there was. There have also been times when I was readily trusted because of assumptions regarding where I was from. Here in New Mexico my family sticks out like a sore thumb and we have yet to be accepted in this culture. Whether it is my language that is affecting this resistance to us I can't be sure, but I have a feeling that if I spoke a little differently and looked a little different the acceptance time span might not be quite as long. I can't say one way or another as to whether or not that is a good or bad thing, but I can say that as an educator I can't afford to be that way. I have one shot with my*

students and language notwithstanding I must make a connection, so I can't exclude or make a student "pay their dues" in essence before they are allowed to be a part of my classroom culture and that is what my language has taught me.

Amelia: *Language is central to the human experience, central to our identities, how we solve problems, think, learn, and interact with our environments. Perhaps it is our most powerful tool to access social, academic, and vocational opportunities in life. A first language is also the glue that binds parent-child relationships. My first language was the majority language, English. But language interacts with social forces. While the majority of the world's population speaks at least two languages, recent estimates suggest one-in-five children in the U.S. learn two languages beginning in early childhood (U.S. Department of Education [USDOE] and National Institute of Child Health and Human Development [NICHD], 2003). Unlike early developing bilinguals, I grew into a fully acquired English as my home, social, and academic foundation to which I could later map the second language of my choice.*

Although my grandparents spoke German in early childhood growing up with extended family on farms in middle Texas, our heritage language and tradition were intentionally abandoned as my great uncles enlisted in the U.S. services in WWI and again in WWII to fight against Nazi Germany. Although my grandmother continued to use some German-language recipe cards and a few Christmas carols, I can recall no other distinct German rituals or traditions present in my childhood. My relatives left Europe at the time of drought and famine so common in the mid- to late-1800s, so the shame of Holocaust only provided further assimilation and allegiance to being 'American' for the first and second generations of my family. Myself, as a third-generation German-American, I began to study Spanish as an elective course in middle school. I think this speaks not only to the requirement of foreign language learning in the U.S., but considering the extent to which I adopted a new language and culture as part of my own identity points to how strongly culture binds us on a physiologic scale. At sixteen, my first foreign exchange was in Costa Rica. During college, I found myself in Santiago, Chile to study Latin American history and politics. Later, I would live briefly in Buenos Aires, Argentina for coursework in Speech-Language Pathology. The list of a passion for travel and a choice for second language learning goes on… Bolivia, Brazil, Colombia, Mexico, Uruguay, and Peru. I would like to know Germany and understand more about my ancestry. Use Spanish daily in my personal relationships and work. Surprisingly, or not, this has been controversial for some in my life who have accused me of both rejecting my roots and attempting to claim what is not mine. Yet, whether native to my blood or not, it is this

necessary bilingualism that impassions my identity and career.

Conclusions

While we are not political figures, the policies and plan for global action that Paulo Freire represents should be an obligating call for ethical and advocating education to individuals from every sphere of cultural worldviews and experiences, every racial color and every level of socio-economic status. "Society has a collective value system that still supports traditional roles for men and women. This value system views women who achieve in nontraditional ways as exceptions to the rule. Many women feel like superwomen because they are expected to" (Mitchell, 1993, p. 118). From our own unique experiences in gender, culture, and language, we have highlighted the value added by individual backgrounds and journeys to the passion needed to sustain a career.

Conflicts of Interest

The authors have not declared any conflict of interests.

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Full Length Research Paper

Middle school teachers' views and approaches to implement mathematical tasks

Sibel Yesildere-Imre[1*] and Burcu Nur Basturk-Sahin[2]

[1]Dokuz Eylül Universitesi, Turkey.
[2]Uludağ University, Turkey.

This research examines middle school mathematics teachers' views regarding implementation of mathematical tasks and their enactments. We compare their views on tasks and their implementation, and determine the causes of difference between the two using qualitative research methods. We interview sixteen middle school mathematics teachers based on their professional experience and willingness, and observe task implementations of four. According to the data, we found that the teachers with the most professional experience have difficulty to implement the tasks, they have teacher-centred mentality and they make use of their own experiences as students than of the task itself.

Key words: Task implementation, number patterns, generalisation.

INTRODUCTION

Problem solving, mathematical reasoning and using mathematical knowledge in daily life are the teaching abilities that take part in many countries' mathematics curriculums. Getting these abilities requires accepting them as the appropriate classroom norms during the enactment of mathematical tasks, the purpose of which is "to focus students' attention on a particular mathematical concept, idea, or skill" (Stein et al., 1996). Tasks' is important likewise the abilities which has been touched upon in the literature as increasing the quality of mathematics education (Henningsen and Stein, 1997, p.528.) Horoks and Robert, 2007).

Effective teaching practices require student-centred discussions of problem solving tasks (Boaler and Humphreys, 2005). Especially tasks with real life situations increase student motivation significantly and

push students to work (Stylianides and Stylianides, 2008). Recent studies have reported that tasks affect teachers' conceptual understanding and have positive effects both on a cognitive and affective level (Koichu et al., 2016). Although there is a tendency to view all classroom activities as "tasks" in the mathematics education, in fact an activity must meet certain requirements before considering it as a task. One of the most characteristic properties of tasks is that they must be prepared for in advance; in other words, one must plan for a specific educational purpose. Doyle (1988) has defined the required properties of tasks under four titles:

1. Must have a purpose to be fulfilled, or a result that must be reached (goals).
2. The students must be supplied with all of the tools

required for the task to be achieved (resources).
3. The correct operations need to be applied to achieve the goal using the resources supplied (operations), and
4. The effect of the task on student achievement needs to be determined (responsibilities).

Looking at the necessary steps for planning a task, we can say that the first thing is to determine a purpose, such as solving a certain problem, or reaching a generalization. The next is the use of resources, such as study notes, books, solution models provided by the teacher, materials etc. Designing a task finalize by executing operations such as, going over the previous lesson to help with the completion of the task, applying a rule, going through the steps necessary to reach a generalization; and determining what percentage of the students' pass grade should be affected by the task.

When reviewed through these items, it is clear that task designing needs a pedagogical preparation and to keep the implementation process in mind. A task focusing on the cognitive domain can affect the student's learning in two stages: designing and implementation (Stein et al., 1996). The task design is the stage in which students obtain detailed explanations and the expectations. The main purpose here is explaining to the students how to approach the task obviously. Giving fruitful answers to the questions such as, "will there be any worksheet", "which documents will students work on" and "which goals are expected" are important for designing a task with which students will work on (Sherman, 2011).

However due to various classroom conditions, students and teachers may unable to reach the potential of a given task (Stigler and Hiebert, 2004). The implementation may diverge from designing, and a high-level cognitive skills demanding task can turn into lower level (Boston and Smith, 2009). Because of this reason, we need to consider designing and implementing together. Teacher enactment is important for revealing the mathematical tasks' potential. Students must have chance to find patterns and reach generalizations, as well as being in central role in order to verify the results and defend them (Yackel and Hanna, 2003). Posing questions about whether they gave correct answers or not, or if they are sure they have reached all potential results create opportunities to reason mathematically (Franke et al., 2009). Considering teachers' role to shape the tasks they enact, the implementation of tasks is at least as important as the designing them. Thus, it is important to determine factors that may affect the implementation during designing, and then implement the task accordingly.

Henningsten and Stein (1997) have examined classroom factors affect tasks that allow students to use high-level mathematical thinking and reasoning, and have summarized the relationship between the task and students' learning as seen in Figure 1.

According to the schema, the mathematical task leads to learning outcomes in three stages: "first as curricular or instruction materials; second, as set up by the teacher in the classroom; and third, as implemented by students during the lesson" (Henningsen and Stein, 1997). In that case, teachers set up mathematical tasks that are designed by curriculum planners in order to enact in the classroom. The objectives set by the teacher, and the teachers' knowledge of subject matter and student affect this process. The teacher may give explanations that increase student motivation.

One other dimension is cognitive requirements. Cognitive demands involve the explanations given to lead the students through the thought process leading to solving the task. The factors affecting the task implementation process are classroom norms and task conditions, the teacher's instructional dispositions and the students' learning dispositions.

Classroom norms include by whom and how will the task be executed, and the qualities and responsibilities expected for execution. Task conditions are a factor involving properties such as what previous learning students must have, and how much time is necessary for the completion of the task. The factor containing how the pedagogic and learning approaches of the teacher and the students affect the execution of the task in the classroom is student and teacher tendencies. All of these stages and factors have influence on the quality of learning outcomes.

Although differently categorized by different research, there is a consensus within the literature regarding the principles of task design (Ainley, 2006; Bell, 1993, Liljedahl et al., 2007). At this point, the question seems to be do tasks designed according to these principles have the desired effect on students. Put differently, to what extent does the consistency between the designing objectives of tasks and their modes of implementation affect the mathematical learning? This question is important for defining the problems faced during the implementation process of tasks and for reflecting the theoretical task principles in the classroom implementation level. When looked at through the perspective of mathematics education in Turkey, the efficiency level of tasks used in mathematics are very low and the consistency with task planning principles is less than expected (Kerpiç and Bozkurt, 2011).

One reason for classroom task implementations mistakes that occur is that curriculums and textbooks fail to explain implementation clearly. Lack of explanation is one of the several issues that generate mistrust and negative attitudes toward using tasks to teach mathematics. Correct definitions and explanations of classroom task implementation are equally important as determining task planning principles.

Some research has been conducted on the task design and implementation. Silver et al. (2005) conducted a study with experienced teachers to identify the reasons
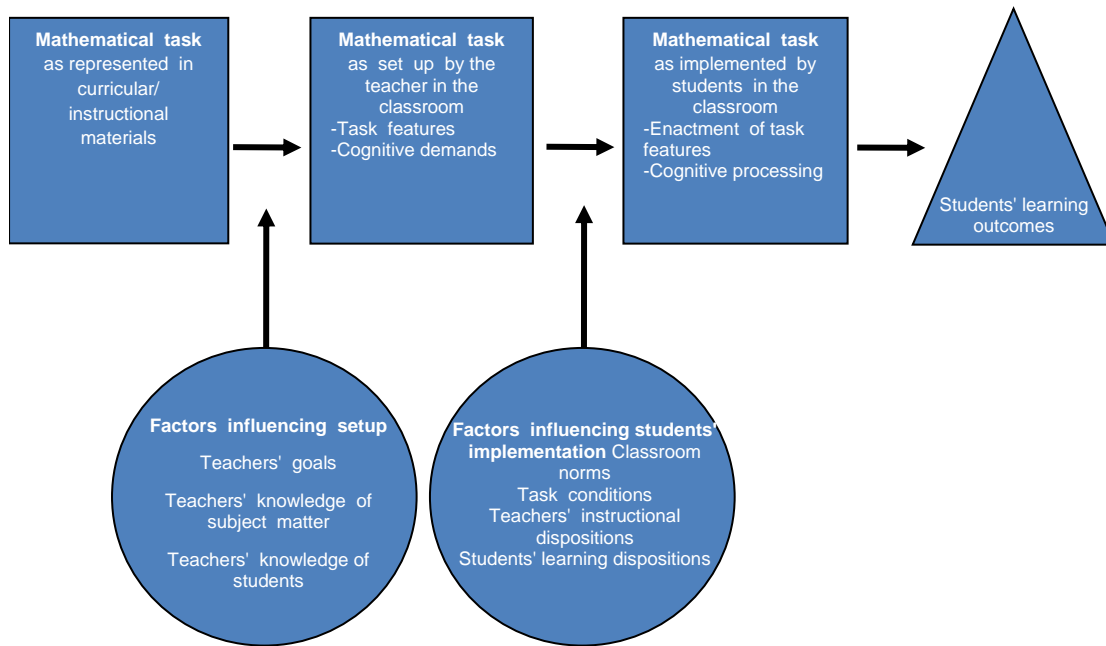
Figure 1. Relationships among various task-related variables and students' learning outcomes (Henningsen and Stein, 1997)

why tasks could not reach their aims. Klusmann et al. (2008) investigated the relationship between teachers' instructional performance and occupational well-being. Stigler and Hiebert (1999) interviewed the teachers to mention the differences between the implementations of tasks. Berg (2012) examined two teachers' task implementation processes and the differences between them, and emphasised the possible changes according to teachers' aims in the study. In an attempt to contribute to this growing literature, the aim of the research is to find out the factors that affect the task implementation of middle school mathematics teachers. Research questions of the study are:

1. What are the views of middle school teachers about designing and implementing mathematical tasks?
2. What are the approaches of middle school teachers to implement mathematical tasks?

Generalizing number patterns

Generalizing number patterns is an important concept for developing students' algebraic thinking. In order to help students to develop their algebraic thinking it is crucial to focus on algebraic form through numeric relations rather than using trial and error method while finding the general term of a number pattern.

According to Radford (2008) who approaches number patterns with this perspective poses three kinds of generalizations: algebraic generalization, arithmetic generalization and naïve induction. Radford (2008) suggests finding the rule of a number pattern using algebraic generalization. The algebraic generalization process is comprised of the following stages: noticing a commonality of the number pattern, examining whether or not the commonality is consistent in other terms of the pattern, and composing a general rule for finding any term within the pattern. Figure 2 shows the architecture of algebraic pattern generalizations.

When the focus is on a certain part of the number pattern, instead of the whole, the generalization reached does not serve to find any term within the pattern and does not have an algebraic structure. The arithmetic generalization process consists of noticing the common trait of the number pattern, and examining whether or not it exists in other terms of the pattern. The last stage of the algebraic generalization (reaching the expression p_n) does not exist in the arithmetic generalization. Pointing out relations between terms using numbers and finding the consecutive term are the examples of arithmetic generalization.

Naïve induction expresses reaching a generalization by trying out any rule, rather than reaching a rule through generalization. The naïve induction process includes the first and last stages of the algebraic generalization process. Finding the general term of a number pattern through trial and error, without examining the relations between the terms within the pattern is an example of naïve induction. In this regard, Radford (2008) expresses

Figure 2. The architecture of algebraic pattern generalizations (Radford, 2008)

that naïve inductions are different from generalizations in that way.

If an example is to be given; a student who discovers the relation between the numbers when trying to find the general term of the number pattern 3 5 7 9… and reaches the rule $2n+1$ makes an algebraic generalization. During this process, the student may use visual aids, like tables and models. A student, who focuses on the relation between the numbers an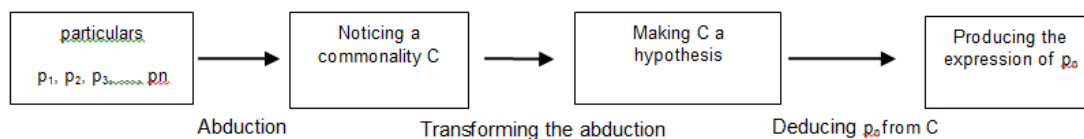d is able to point out that they increase two by two, reaches an arithmetic generalization. If someone, who does not conduct any examination of the number pattern, but instead tries to determine the correctness of certain algebraic expressions through trial and error uses naïve induction.

METHODOLOGY

The research model

Yin (1994) suggests determining research model regarding researchers' control over research situations, and the focus. Accordingly, we designate qualitative research model according to our research problems. Case study is the research strategy selected which is based on the detailed examination of a specific case in order to examine how mathematics teachers apply tasks in classrooms in detail (Wiersma, 2000). Since it is in the nature of case studies to understand social phenomena, interview and observation are two of the most commonly used qualitative methods. In order to gather information on teachers' views on the task design and implementing, interviews was conducted. Yet, as Patton (2014) has pointed out, we think that the participants may be unqualified to give adequate information. Because we think that the teachers may not be able to identify their in-class behaviours that have become habitual, and we utilised the observation method to assess their behaviour while implementing tasks.

Participants and setting

Due to the nature of qualitative studies, we regard participants not as a source in which equal information is gathered from each of its members, but as a source from which information on particularly rich situations can be gathered (Wiersma, 2000). Since this situation requires purposeful sampling, we select the participants on purpose. We used the criterion sampling that is one of the purposeful sampling methods in qualitative studies (Yıldırım and Şimşek, 2008).

The criterion specified in selecting the participant teachers are; willingness and professional experience. We group the teachers as less experienced than fifteen years and those with more

experienced than fifteen years. We talk to the teachers individually to specify those who would voluntarily participate in the study. We continued the research with voluntary teachers. Table 1 presents the participants in-group.

Ministry of National Education and the administration of the middle schools give necessary ethical permission for research. Sixteen middle school teachers first interview about task and task enactment using "Pre-Interview Form". Afterwards we chose four of them based on their answers in pre-interviews and they implemented readily given tasks to the thirteen years old students. The classrooms consist of about thirty-five students. Students have experience about number pattern but not have any knowledge about the effective use of pictorial representation of a pattern. The observations were conducted with care in order not to disturb the teachers' and schools' routine.

Data collection tools

There are two data collection tools in the research. These are "Pre-Interview Form" and "Generalization Tasks (GT)". The main objective of the pre-interview form is to learn about mathematics teachers' views on task design and task implementation. We utilized the analytical framework designed by Stylianides and Stylianides (2008), who have done work on the classroom implementation of mathematical tasks, and the theoretical framework provided by Henningsen and Stein (1997) in designing the pre-interview form. We also used GT, which aims to help students to learn number pattern generalization with multiple representations. Aslan (2011) developed GT considering task design principles and student difficulties reported in the literature based on Swan (2007) theoretical framework as part of her master thesis.

Data analysis

All interview records were transcribed word for word. As Yıldırım and Şimşek (2008) have suggested for qualitative data analysis, we segmented and examined the data gathered, and determined the categories required for comparison and conceptualization. Categories for pre-interview form are; *attention points during task design, purpose of task implementation, use of tasks in lessons, points of attention during implementation, difficulties during implementation* and *effect of task implementation on learning*. Categories for GT in terms of the factors affecting students' implementation of tasks in the classroom are *task conditions, classroom habits and teaching approaches*.

Validity and reliability

A pilot study for pre-interview form with six teachers and edit accordingly misunderstood questions was conducted. Aslan (2011)

Table 1. Participants grouped according to their professional experience.

Less experienced than fifteen years	More experienced than fifteen years
K_5 K_6 K_7 K_8 K_9 K_{10} K_{13} K_{14}	K_1 K_2 K_3 K_4 K_{11} K_{12} K_{15} K_{16}

who designed the GT presents detailed validity and reliability in her master thesis. For the validity of the data analysis, the criteria considered are credibility and transferability. For credibility, we used researcher triangulation. The coding acquired during the data analysis conducted by the two researchers separately and later compared in order to reach a mutual categorization. The detailed description strategy was utilized in order to achieve validity of the analysis of the interview and observation data.

FINDINGS

In this section, we present the data gathered with the titles "views of mathematics teachers" and "classroom observations."

Views of mathematics teachers

According to the analysis of the data obtained through the pre-interview form on teacher processes of task planning and implementation, we emerge the following categories: points to consider in task design, the purpose of task implementation, place of tasks in lessons, points of attention during implementation, difficulties during task implementation, and effect of task use on learning. Categories and sub categories along with their frequencies are presented in Table 2.

As seen in Table 2, we collect the data on task designing under four categories. One of the sub categories is learning outcome. Participants who think tasks should focus on learning outcomes have expressed that tasks toss the topic into different places, and do not help to reach a conclusion otherwise. Although teachers agreed that tasks should focus on student outcomes, their opinions on outcomes differ on what is the extent of outcome. The number of learning outcomes seems to be the main point of difference among teachers: one single task for each learning outcome or a task for more than one learning outcome. K_2 stated his opinion as follows:

"… [The task] should not complicate the concept too much. I mean, the task needs to focus on a certain outcome you need to give. It shouldn't be too detailed."

Another participant (K_5) pointed out that the task should aim to teach the whole of the outcome, and explained:

"… Tasks are good but they handle the concept at all points. They remain on a single, small piece. Therefore

40 minutes flies with a particular part of the concept, we don't have time to emphasize the other features of the concept."

Well-structured tasks are another emphasize of teachers. Some of the teachers touched on the importance of well-structured tasks and underlined that teacher must prepare it before the lesson before implementation. K_6 explained his/her point of view as:

"… The task needs to be very well structured. If a teacher uses a task, then s/he will plan it right from the beginning to the end. S/he must consider every stage of the task for the duration of 40 minutes. Of course spontaneous situations might happen during lesson but the teacher must plan most of it and be prepared accordingly."

Similarly, K_7 has expressed the importance of clarity of the stages of the task:

"It needs to be well communicated. For instance, when I give a performance task to students, I explain it step-by-step and give them a photocopy. The tasks should be worked on like this."

Some of the teachers found the visuality and interestingness of the task as important as the content. K_1 explained this opinion as:

"… [The task]... must be colourful, because when the child looks at the colours their colour perception becomes much higher. I'm not talking about painting or drawing, because just merely drawing is no use."

Some of the participants have pointed out that the task must both have conceptual and interesting aspects. One of them, K_9, said this:

"… some [tasks] are really too simple and aren't really aim to make the topic understandable […] being fun is a must, but well, also it has to be in a way that makes the child constantly curious about the next step. Students just glance over the task and say, I already know this. Tasks could be more interesting, more intriguing."

The two prominent sub-categories that stand out for first category are learning outcome based and well planned. We observed that the teachers mostly expressed that a task should have these two features. The second

Table 2. Participants' views on task design and implementation.

Categories		Participants	Frequency (f)
Points to consider in task design	Being visual	K_1, K_{12}	2
	Focused on learning outcome	K_2 K_3 K_5 K_8 K_9 K_{10} K_{11} K_{12} K_{13} K_{14} K_{16}	11
	Being well planned	K_5 K_6 K_7 K_9 K_{10} K_{11} K_{12} K_{13} K_{14} K_{15}	10
	Being interesting	K_6 K_8 K_9 K_{11}	4
Purpose of task implementation	Motivation	K_4 K_2 K_{13}	3
	Conceptual learning	K_2 K_5 K_{13} K_{14}	4
Place of tasks in lessons	Use	K_2 K_3 K_5 K_6 K_7 K_8 K_9 K_{10} K_{11} K_{12} K_{13} K_{14} K_{15} K_{16}	14
	Not use	K_1 K_4	2
Points of attention during implementation	Active participation	K_3 K_6 K_9 K_{10} K_{12} K_{13} K_{14}	7
	Preparing the materials beforehand	K_6 K_7	2
	Coming prepared (for students)	K_8 K_9 K_{15}	3
	Teacher guidance	K_2 K_3 K_{10} K_{11} K_{14}	5
	Spontaneous response	K_3 K_6 K_{11} K_{13}	4
Difficulties during implementation	Inconvenient classroom conditions	K_1 K_3 K_4 K_5 K_7 K_8 K_9 K_{10} K_{12} K_{14} K_{15} K_{16}	12
	Insufficient time	K_3 K_4 K_5 K_6 K_8 K_{12} K_{13} K_{14} K_{15}	9
	Different success levels	K_5 K_6 K_{10}	3
	Classroom management	K_2 K_6 K_{15}	3
Effect of task use on learning	Effective	K_5 K_6 K_7 K_9 K_{10} K_{11} K_{13} K_{14} K_{16}	9
	Not effective	K_4 K_8	2

category is teachers' objectives for task implementation, which has two subcategories. One of them is conceptual learning. On this subject, K_{13} expressed:

"… [The task] extends my lesson plan three minutes more, but students understand the concept better. This is what a task means to me…"

Similarly, K_2 has also expressed the reason for using tasks as it increases student understanding:

"… when [the task] implemented, students understand the topic better. […] I really prefer using tasks in that regard."

The other subcategory of teachers' purpose is motivation. Some of the teachers expressed that tasks increase student motivation. One example is K_2's opinion:

"Tasks motivate the students. Because they get bored of constantly writing, they would like to work by themselves.

Because students practice and reach conclusions by themselves with the use of tasks, I think they really support the learning"

K_4 has also explained the reason for implementing tasks as:

"…this is also about the children's motivation. Believing in what they will learn, rather than what the teacher will teach them gives them pleasure."

The third category is place of tasks in lessons. Two of sixteen teachers stated in interviews that they did not make use of tasks in maths lessons. One of them, K_4, explained the reason as:

"Up till now I haven't [enacted tasks]. The reason is my classes' size; very crowded. I give tasks as homework to the students."

Contrary to the teachers who prefer not to implement

tasks, K_{13} stated that they prefer to prepare tasks, especially the tasks designed by him/her:

"I use tasks as often as possible in my lessons […] and I prepare most of my tasks myself."

We group the forth category, points of attention during implementation, into five subcategories. The first of these is active participation. One of the teachers who find active student participation important is K_3, who has explained this with the following words:

"...student's participation affects all of the students. I always pay special attention to include all of the students in the classroom."

Some of the teachers, who find the active participation important, have also emphasized that students must understand the task completely. K_6's view is an example of this:

"If students did not understand the task, I'm saying, let's question this... maybe some of the students did not understand something... We need to notice these and observe the students well."

The second subcategory is the teacher's guidance during implementation of tasks. Teachers pointed out the importance of guidance, and being aware of and acting according to students' individual differences. K_{10} shared ideas with the following words:

"It's very important do draw attention of students. When we focus on children with different learning levels, or students with high intelligence, or high perceptive capacity, who can't answer the simplest questions, or have difficulty understanding the simplest examples, who's attention we can barely get, who have economic hardships, or are afraid of either the lesson or teachers, when we consider them it becomes easier."

In addition, K_{13} has explained the importance of the teacher's guidance within student-teacher interaction:

"First of all the eye contact with the students is very important […] they give you the signals. You act according to the reactions you get from the students."

The third and fourth subcategories are "coming prepared for the task (for the students)" and "preparing the necessary materials beforehand". The participants believe it is better for the students to come prepared for the task because this makes the implementation easier. K_8 explains:

"… I suppose it is better coming prepared for the task. I think if teacher explains and students study on it at home before the lesson, task will be over sooner."

Teachers argued the implementation becomes difficult if the necessary material is not ready. K_7 has expressed their opinions thusly:

"Firstly, attention needs to pay providing the children materials. I mean, the class's economic situation. If material is not provided it is not possible to implement the task successfully."

Similarly, K_{10} has pointed out the importance of having the material pre-prepared, and mentioned that there should be material preparation rooms in schools.

"… Most importantly, if only, there were material preparation rooms in every school with let us say rulers, craft knives, carton, and glue. In order to prepare we need extra time and elbowroom."

The final subcategory is spontaneous response, indicating that teachers should be able to change up the lesson according to their requirements in the classroom. K_{13} states:

"… The task might not go as you imagined in your head once it starts. It begins in your head, but then depending on the condition of the class, students might get bored. You need to quit the task because it did not work at that point. You must not insist on continuing the task implementation just because you started. In addition, if you complain to the children that you implemented this task with the students from different class and it worked, you will label them and the task implementation will go in a worse direction. The teacher must be able to discern these and know when to stop himself or herself".

This is an important aspect of task implementation, however very few teachers underlined this statement. The fifth category is about the difficulties encountered during implementation of tasks. We group this category into four subcategories. These are inconvenient classroom conditions, lack of time due to curriculum, different success levels, and classroom management. Twelve of the sixteen teachers said that inconvenient classroom conditions have led to the implementation difficulties. K_9 has said that the number of students is also a problem during implementation:

"… The sizes of classes I teach are always around 35 people. It is difficult to control students because of crowded. I mean, it is not easy to check their understanding in the beginning and during of the task one by one. I have no other problems to implementation of task apart from that."

Another classroom difficulty teachers touch upon is the lack of special mathematics classrooms in schools. K_1's

view is as follows:

"It's good to implement tasks, but this necessities maths classroom. Students need to work in groups [...] But because classes are overcrowded it takes time to come and get them into a certain sitting arrangement, getting the belongings, students, desks in a certain order every time. I mean if there was a mathematics classroom, where the students would be readily prepared and these weren't required, than it would be done easier..."

In addition, the teachers emphasized that mathematics curriculum had so many subject to teach. Therefore, they could not give enough time to students for tasks. One of the teachers who expressed difficulties with time management due to the curriculum is K_5, who said;

"Implementing tasks is actually positive, in theory. In fact, it is also good for some of the topics. But crowded classes and the volume of topics make it impossible to implement the given task for each lesson."

Similarly, K_8 has explained the difficulties due to curriculum:

"I admit that tasks are helpful, but because of time restrictions we don't always implement tasks. OK it is helpful, the children are entertained and tasks make them happy but we also have topics to cover. There are so many topics to teach in the maths curriculum. I mean if it becomes simpler in the future, then maybe we can implement the tasks in a calmer and more comfortable manner."

Three teachers mention that the different success levels of students complicate task implementation. K_{10} who is one of these teachers explains:

"When some of the students get the task quickly and express the opinions rapidly, implementation can be negatively affected."

Some teachers have pointed out that they have difficulties managing the class during task implementation. For example, K_2 has spoken on having difficulty to control communication between each other in the classroom:

"Well yes, there is some noise. Some experts say, learning creates some noise; but also a good learning happens in a noiseless environment. We try to keep it balanced."

K_6 has emphasized the difficulties that arise when the students work in not properly arranged groups, and expresses his/her views as such:

"In very crowded classes task implementation can lead to noise, commotion and disorder. In that sense, the

students need to work in groups; we must organize the groups carefully. Sometimes one student in the group dominates the other members, and none of the others does any work. Then we must organize the groups carefully."

The sixth category is the effect of task use on learning. Nine of the teachers have argued that it does matter. K_{13} explained his/her views as:

"... It certainly is [effective]. As previously stated, teachers' activeness, control over the students, command over the task and problems you may encounter, you have to foresee these things before the implementation. You need to know the students well. Without these the task won't achieve its purpose anyway."

When we evaluate the findings from the teacher interviews, we conclude that they mostly dwell on good planning and learning outcome based approach in task design. About the purpose for implementing tasks, there were no views that particularly stood out, but some stated that their objective was to motivate or achieve conceptual learning. Most of the teachers mentioned that they implement tasks, and during implementation, their focuses were to get active student participation and supply effective guidance. While they think that, the ways of task enactment affect the learning due to curriculum and inconvenient classroom conditions they have problems with implementation of tasks.

Classroom observations

We examine the data gathered on the teachers' task implementation based on two headings in line with Henningsen and Stein (1997) framework:

1. Factors effecting teachers' (re)composition of tasks
2. Factors affecting students' implementation of tasks in the classroom.

Factors affecting teachers' (re)composition of tasks

According to the theoretical framework subject matter knowledge, student knowledge and objective affects teachers' (re)composition of tasks. When the data were analysed considering these three factors in mind, the categories here show up as use of strategies, use of multiple representations, and use of explanations and justifications.

Radford (2008) defined the category for strategies addressed with "architecture of algebraic generalizations" conceptual framework. As such, the subcategories for use of strategy are algebraic generalization, arithmetic

Table 3. Factors affecting teachers' implementation of tasks in the classroom.

Categories		K_{13}	K_5	K_6	K_2	K_{15}	K_4
Use of strategies	Algebraic generalization	√	-	-	-	-	-
	Arithmetic generalization	-	-	√	-	√	-
	Naive induction	-	√	-	√	-	√
Use of multiple representations	Tables	-	-	-	-	-	-
	Visual models	√	√	√	√	√	√
	Verbal	√	√	√	√	√	√
Use of explanations and justifications	Numerical	√			√	-	-
	Algebraic	√	√	√	√	√	√

generalization and naïve inductions. The subcategories of multiple representations are tables, and visual models.

Finally, subcategories of explanation and justification are verbal, numerical and algebraic. Table 3 summarizes these categories and subcategories. In terms of use of strategies, we expect to generalize patterns with the aid of visual models provided, and to reach an algebraic generalization using the using the *n* notation. As seen in Table 3, three of the teachers' approach was naïve inductions; two of them made arithmetic generalizations and one of them preferred algebraic generalizations. One of two teachers who make use of arithmetic generalizations, K_6, stated his/her point of view as follows:

"…Are there unchanging or stable parts in the visual models in every step? […] on the first step I added one to each, on the second step I added two to each, on the third step I added three to each; so then can there be a relationship between them? You've already found that as many squares as the number of steps will be added next to the white model."

Yet, K_5 has only expected the students to state the rule, which means K_5 made use of naïve induction when generalizing patterns. K_5 has explained his/her strategy as:

"We increased the visual models by adding four to each, but look, in the first on there are five squares, in the second there are nine. If it goes on like this, how many squares would be in the ninth step?"

According to an observation, only K_{13} used algebraic generalization strategy. K_{13} made the following explanation in class:

"… We added two bars in every step. Then in order to find the tenth step, we multiply ten by two. Therefore, we add twenty bars. However, here in the first step there are additional three bars, so we add one."

The tasks given to the teachers had both tables and visual models. Nevertheless, all of the teachers preferred to generalize the patterns with the aid of visual models alone. In terms of the use of explanations and justifications category, all of the teachers participating in the study have supplied algebraic explanations and confirmations. K_{13} and K_2 have used all three types of explanations. In addition, K_{13}, not only explained the relation between steps but the relation of the number of the step to the step itself.

"In the first step there are 5 square units, in the second step there are nine square units. Therefore, there is a four square unit increase between each step. Then we multiply the number of the step by four, and then add one (4.1+1). Now let us see if we can control all other steps like this (4.2+1=9). Then how can we find the 75th step? (75.4+1)"

In sum, factors affecting teachers' (re)composition of tasks class are use of strategies, use of multiple representations, and use of explanations and justifications. Teachers tend to make arithmetic generalization and naive inductions rather than algebraic generalizations. They prefer to use visual models instead of tables, but they did not effectively use them to reach algebraic rule. Mostly they used them for visualisation. Although they did not use algebraic generalization, they wanted students to use algebraic notation with the use of trial and error.

Factors affecting students' implementation of tasks in the classroom

According to the theoretical framework, the factors affecting task implementation are classroom and task conditions, teachers' instructional dispositions, and students' learning disposition. With these factors in mind, the following three main categories appeared are task conditions, classroom habits, and teaching approaches (Table 4).

Table 4. Factors affecting students' implementation of tasks in the classroom.

Categories		K_{13}	K_5	K_6	K_2	K_{15}	K_4
Task conditions	Understanding the nature of the task	√	-	√	-	√	-
	Misunderstanding the nature of the task	-	√	-	√	-	√
	Adapting tasks according to conditions	-	√	√	√	√	-
Classroom habits	Informing about the lesson	√	√	√	-	√	√
	Acting as a whole	-	√	√	-	√	-
	Allowing to work individually	√	-	√	√	-	-
	Prioritizing taking notes	-	√	-	√	-	√
Teaching approaches	Asking supportive questions	-	-	√	-	√	-
	Asking one-way questions	-	√	-	-	√	√
	Using reinforces	√	-	√	-	√	-

As seen in Table 4, we analysed the factors affecting students' implementation of the task within the classroom through the context of the teacher. We take into account understanding the nature of the task correctly, being able to adapt it, the habits that came to be through the teachers' interaction with the class, and teacher approaches during task implementation considering framework. As previously stated, given tasks required the use of both tables and visual models. However, only three of the teachers understood the nature of the task. For example, K_5 used visual models in order to write the pattern numerically:

"How many cubes are there in the first step? In the second, third steps, how many cubes are there, write them underneath the model"

K_5 preferred to directly turn the visual model into a number pattern, rather than make effective use of it. K_5 also opted not to ask some of the questions existing within the task to the students, instead attempting to adapt the task to the situation. K_{15} similarly explained skipping questions during the task as:

"Our figure is here, I only want the number of bars in the fourth step. And I want the rule of the pattern."

K_{15} has preferred to ignore the questions asking the number of bars for the 100 and 1000th steps. As a result of the observations, some of the habits teachers have in the classroom came to attention. K_4 has a preference to inform the students of what they will be doing at the beginning of the lesson:

"…In our lesson today we're going to see patterns. We will learn how to find a general rule. In order to do these

we'll start with exponential numbers, what is an exponent, what are the base numbers, how to multiply exponential numbers…"

K_2 however, preferred instead to start by asking what the pattern is without giving any explanation. Along with this, some of the teachers gave information about the tasks and their enactment at the beginning of the lesson. For example, K_6 has expressed the wish to perform the task with the whole class together as follows:

"…Wait, we're not starting yet. We are going to do it together. Let everyone get it. We will go step-by-step. Yes, we're looking at first task"

Contrarily, K_{13} has expressed allowance for individual performance with these words:

"In the second task, we see the term and its number. Let me give you some time […] Think well. I'm coming over to you […] Now everybody read the task thoroughly yourselves…"

K_6 while preferring to walk through the task altogether with the class at the beginning, allowed the students to work on the tasks by themselves after some time. Some of the teachers were sensitive about note taking during the lesson. K_4 has given extra time for the students to take notes:

K_4: Do you understand? Do you know the difference between this and that? You would better to write it down real quick, come on.
Students: Teacher, we are still writing.
K_4: Alright, write it down, I'm waiting…."

Contrarily, K_{13} has said that the students could not learn

thoroughly while writing:

"…Can we look this way please? I do not want you to write, I want you to learn. OK?"

In addition, teachers approached the students with the aid of one-way or supporting questions. One-way questions refer to the questions teachers ask the students within the lesson, yet answer themselves. The following excerpt from K_5 is an example:

"Have we discovered a rule about n*? Yes, we have. How did we discover this rule? We looked at the relations between the numbers. We looked at the increasing and decreasing numbers in this model. Thus, we have found the rule. Can we find a rule through this model? Yes. What was this rule? 5n+3."*

K_{15} however, instead of telling the students they made mistake when they give a wrong answer, used questions to notice:

"So you're saying that in one square four bars are used […] now look, for three squares ten bars have been used. Can we do this with ratios then? Can such a ratio exist for these?"

Another dialogue in which K_{15} uses supportive questions went like this:

Student: It increases by three. For example in the third step there are ten, I used my fingers for each. 13, 16, 19, 22, 25…
K_5: Hmm. You used the finger counting method. Well, if I were to say how many bars do you need for 50 squares, how would you calculate? How many bars do you need for 100th step?

Along with this, K_{13} has used supportive questions, not to get students to notice their mistakes, but to make it easier for them to reach generalizations:

K_{13}: What is happening with each step?
Student: It increases.
K_5: How much does it increase? […] It increases more here. What is happening, how much does it increase by each time?

The participant teachers, along with the explanations they made to correct the mistakes of the students, as seen as earlier stated, they have also used certain reinforces for their correct expressions. For example, K_{13} has used reinforces such as;

"That's it! You are great. […] Thank you, that's exactly the sentence I wanted." during class.

Similarly, K_6 has said
"You're wonderful. You may applaud yourselves."
for their contributions to the tasks.

To sum up, the factors affecting students' implementation of tasks are task conditions, classroom habits, and teaching approaches. Teacher had difficulty in understanding the nature of the task, which affects the implementation at all. Teachers' classroom habits differs as informing about the lesson, acting as a whole, allowing to work individually and prioritizing taking notes. Teachers teaching approaches are mostly based on one-way questions and reinforces.

DISCUSSION AND CONCLUSION

The purpose of this research has been to examine the task implementation of middle school mathematics teachers. We aim to find the factors affecting the task implementation and draw attention to transition between designing and implementing. In this section, we summarize and interpret the findings along with some suggestions in terms of mathematics education.

According to findings, most of the teachers have preferred to make use of multiple representations. Mostly used representations were tables and visual models. However, the explanations of teachers about the representations deprived from meaning were used. Almost all teachers used visual models without focusing on its relationship with the pattern; they made mistakes of counting the shapes, converting the visual patterns into number patterns, and confusing model use with ornamentation. Teachers' lack of subject matter knowledge prevented the implementation of tasks.

Teachers' views were grouped under four subcategories about designing a mathematical task. One of them is that the task must focus on learning outcomes. Participants that were of the idea that the task should be a learning outcome oriented which have stated that tasks that do not focus on learning outcomes tend to scatter the topic and make results difficult to reach. Along with suitability to learning outcomes, another point of focus was tasks structure. Teachers who made this point have emphasized that teachers should implement the tasks after a thriving preparation. Mostly referred subcategories are focus on learning outcome and structuring the task properly. Giving time for the task and alerting students to focus on the tasks is important for teacher behaviours that help students focus on the task (Doyle, 1988).

According to results, we found that twelve of fourteen teachers implement tasks in their math lessons. Some of the teachers were less interested in the content of the task, but more interested in their visual qualities and interestingness, thinking of the tasks as a way to motivate students. The matter most often emphasized by teachers

is active student participation, teacher's guidance during the task, and spontaneous interventions during the lesson. Other matters of importance were students and materials state of readiness before the task implementation. Metin and Özmen (2009) studied on the issues that teachers face while designing and implementing mathematical tasks with 5E model. Similar to this study finding they emphasised that effective use of time, classroom management, students' motivation, in short, teacher qualifications are very important for implementation.

About the difficulties faced during implementation of a task, teachers have mentioned that inconvenient classroom conditions create issues. Tasks' implementation ways also affect whether or not they reach the desired result; generally, the participants argued that it does. Teachers' implementation ways varied depending on professional experience; more experienced teachers' ways are consistent with teacher centred approaches.

Based on observations, we saw that most of the teachers found the rule of number patterns through naïve inductions. The tasks given to the teachers contained number patterns that required use of both tables and visual models, yet all of the teachers preferred to generalize with the aid of only visual models. Teachers' understanding of the tasks' nature, their ability to adapt the task, the habits they developed in the classroom and their approach instructing the students were the second dimension of the theoretical framework of this research. As stated earlier, the tasks required the use of both tables and visual models. However, only three of the teachers were able to understand the nature of the task correctly. The tendency was to directly convert the visual model into a number pattern, rather than make appropriate use of the model.

The research findings indicated that teachers must implement tasks following student centred pedagogy. When this does not happen, tasks do not tend to give the intended results. If teacher implement student centred task with a teacher centred manner, the students are unable to get the intended gains from it. This finding brought to attention the importance of developing students in an environment where they are the subjects of their own learning (MEB, 2013). In this case, we suggest preparing tasks in a way that puts the student in their centre; and with cohesion between the designing objective and implementing objective understood by the teacher. This finding puts teachers' importance during task implementation. Likewise, Watson and Mason (2007) stated that student learning is not only affected by students' action on task, but also teachers' interpretation and instruction.

We determined inconsistencies between the answers given in the pre-interview and classroom observations in terms of teaching number pattern generalizations. For example, although the teachers gave answers on

teaching number patterns using strategies, we found that they mostly preferred to use trial and error. This finding did not vary by professional experience. All of the teachers with insufficient content knowledge had the same misconception. This finding highlights the importance of having subject matter knowledge.

This study only examines the teacher component of the task implementation process in mathematics classes. Conducting a research, which examines the task implementation with a socio-cultural perspective, paying mind to the student component and classroom norms, is a further research to look into.

Conflict of Interests

The authors have not declared any conflicts of interest.

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Full Length Research Paper

Class interactive reading aloud (CIRA): A holistic lens on interactive reading aloud sessions in kindergarten

Lea Ann Christenson

Towson University, Maryland, USA.

In kindergarten classrooms (5 to 6 year olds) in the United States, interactive reading aloud has long been considered an important part of a comprehensive emergent literacy program. However, while individual components of interactive reading aloud (for example, teacher activity, student activity and text) have been studied, researchers have lacked a model to holistically assess this important practice. Thus, a model was created-Class Interactive Reading Aloud (CIRA)-to use as a lens for the study. Through non-participant observations and interviews covering a four-month period, this case study examined four experienced kindergarten teachers during four interactive read aloud sessions in the naturalistic setting of their classrooms. Strong patterns emerged across the practice of the teachers in each of the components of interactive read aloud sessions. All teachers exemplified the CIRA model to varying degrees. Teacher activity fell along a continuum from highly controlled sessions to sessions that appeared to have little apparent planning. All types of sessions yielded extremely engaged students.

Key words: early childhood, literacy, reading aloud.

INTRODUCTION

The practice of reading aloud to young children in a school setting, prevalent since the beginning of formal early childhood education in the United States, has long been thought to be an important instructional strategy. Baright (1882) encouraged teachers of young children to read aloud as "the exercise of reading aloud is a mental discipline of children in public schools". Today, reading aloud to children is still considered an important part of a comprehensive emergent literacy program (Beck et al., 2003; Delacruz, 2013; Fox, 2013; Pentimonti and Justice, 2010). When reading aloud is interactive, it is an effective tool for teaching the emergent literacy skills children need

to become competent, fluent readers (Henk et al., 2000; Lane and Wright, 2007; Lennox, 2013; Silverman et al., 2013).

In spite of the prevalence and importance of reading aloud to young children in school settings, an extensive review of the literature does not reveal a clear, consistent, or well-defined term, definition, or model to describe this type of reading activity. Instead, the practice of reading aloud to children has many names and definitions: Story Book Reading, Read Aloud, Interactive Reading, or Shared Book Experiences, to name a few. This study illuminates the read aloud practice of four

E-mail: lchristenson@towson.edu.

experienced kindergarten teachers - specifically the interconnected, literacy-related relationships among book, students, and reader (in this case the teacher) - by studying the dynamic interactions between text, student activity, and teacher practice during kindergarten read alouds. Prior studies have looked at these components separately, rather than investigating how they have the potential to work together to build kindergarteners' emergent literacy skills and content knowledge.

Thus, the study employs a model to understand this important teaching practice: Kindergarten Class Interactive Reading Aloud (CIRA: Figure 1). This model was based on the research literature, holistically describes what occurs when a kindergarten teacher reads aloud interactively to a whole class during a planned period of instruction. This would not include times when a teacher reads a book to the class at a random time not as a part of a planned lesson.

Kindergarten CIRA includes elements of teacher activity, student activity, and texts as they interact during a planned instructional period nested in the context of the classroom, school, community and governance. The Kindergarten CIRA model was used as a lens in order to answer the following research questions: What are the characteristics of teacher practice and student activity, and how do these characteristics interact during a kindergarten CIRA session as practiced by experienced kindergarten teachers? Are there any patterns or discernable characteristics and interactions within or across teachers?

METHODOLOGY

This study employed a qualitative method of collective case study in order to create a comprehensive description of interactive read aloud sessions in kindergarten. Data collected included observation transcripts and field notes; informal interview field notes; the formal interview transcripts and field notes; the CIRA Text Logs (teachers recorded the name and author of all the books they read for planned interactive read aloud sessions over the course of the study); and Teacher Information sheets (demographic data such as years of teaching, education, etc.). "Considerable Time" was spent with participants (Guba and Lincoln, 2008) as the study took place over the course of four months, thus yielding a rich description and a complex, holistic picture - the hallmark of qualitative case study research (Creswell, 2007; Nolen, 2001; Sipe and Ghiso 2004). The CIRA model was very helpful in gaining a better understanding of how teacher practice, student activity, and text work together during interactive reading aloud sessions.

The four teachers were purposely selected with the principals of the schools based on their years of teaching experience, their level of expertise in the area of reading instruction, and their overall reputation of being an experienced, competent kindergarten teacher whose students routinely met kindergarten benchmarks and expectations by the end of the year. The principals also selected teachers who had taught for a minimum of two years at the kindergarten level and who were tenured or on track to becoming tenured. All four teachers were white females with between 2 and 25 years of teaching experience. Three of the four had a Masters Degree or its equivalent.

At the time of the initial interview, each participating teacher was given a Whole Class Interactive Reading Aloud Text Log for each of the months of the study to record the title and author of books read during CIRA sessions. In addition, they were given a Text Characteristics Guide and a Text Characteristics Guide Glossary, which was developed in order to make sure that all of the participating teachers characterized the texts using the same terms and the same definitions of the terms.

Qualitative research relies on persistent observations to ensure that enough rich data are obtained. These rich data lead to a "thick" description that gives a full and detailed account of the case in point (Creswell, 2007; Goatley, 2000; Nolen, 2001). In order to obtain thick description through persistent observations, four read aloud sessions of each of the four teachers were conducted, for a total of 16 observations. The read aloud sessions were each discretely audio taped and transcribed. Field notes were taken during the CIRA sessions.

Logistical information for each session was recorded including the date, start, and end time of the observation; the location of the students and teacher for the read aloud session; the number of students who participated in the sessions and whether or not changes had occurred during the observation (that is, did any of the students go or return from receiving special services such as English as a Second Language (ESL) or Special Education). After each of the 16 observations, the audiotapes were transcribed and the field notes were embedded into the transcripts in order to create a complete picture of each read aloud session. The transcripts were then read, re-read, and then coded using the CIRA Protocol (Bogdan and Biklen, 2007; Sipe and Ghiso, 2004). All portions of each transcript were coded.

The same process was employed to code the formal interview transcripts which was used to code the observation transcripts. First, the transcripts were read, and re-read, and each section of the transcript was correlated to each of the research questions. Patterns were then identified within and across teacher observation session and interviews. These data, along with direct quotes from the transcripts, provided a rich description of the 16 read aloud sessions. From these rich descriptions, a collective case study of common characteristics across the practices of all four participating teachers was created using the CIRA model a lens.

After all four read aloud sessions were observed for each teacher, individual interviews were conducted with each teacher at a mutually acceptable time and when the students or other adults were not present. The interviews were audio taped, and field notes were taken when necessary to make sure all the information was captured. Questions for the interviews included ones that clarified and validated what was observed during the four observations. In addition, open-ended questions were asked to assure that all the data had been captured during the interactive read aloud sessions. The participating teachers sometimes had time to chat with the researcher before and/or after the CIRA sessions. These chats built rapport and trust. The conversation were not extensive, but during this time, quite a bit of information was gathered. This information was captured via notes with a pencil and pad of paper, either while chatting or immediately after leaving. These data were a valuable addition to the formal interview data.

Analysis of the data was achieved in several ways. A cross-case analysis was conducted in this case by triangulating across and between observations and interviews (Creswell, 2007). To establish patterns, the findings were verified by checking to make sure there was evidence of the patterns from all of the data sources for all of the participants, including observations, informal teacher interviews,
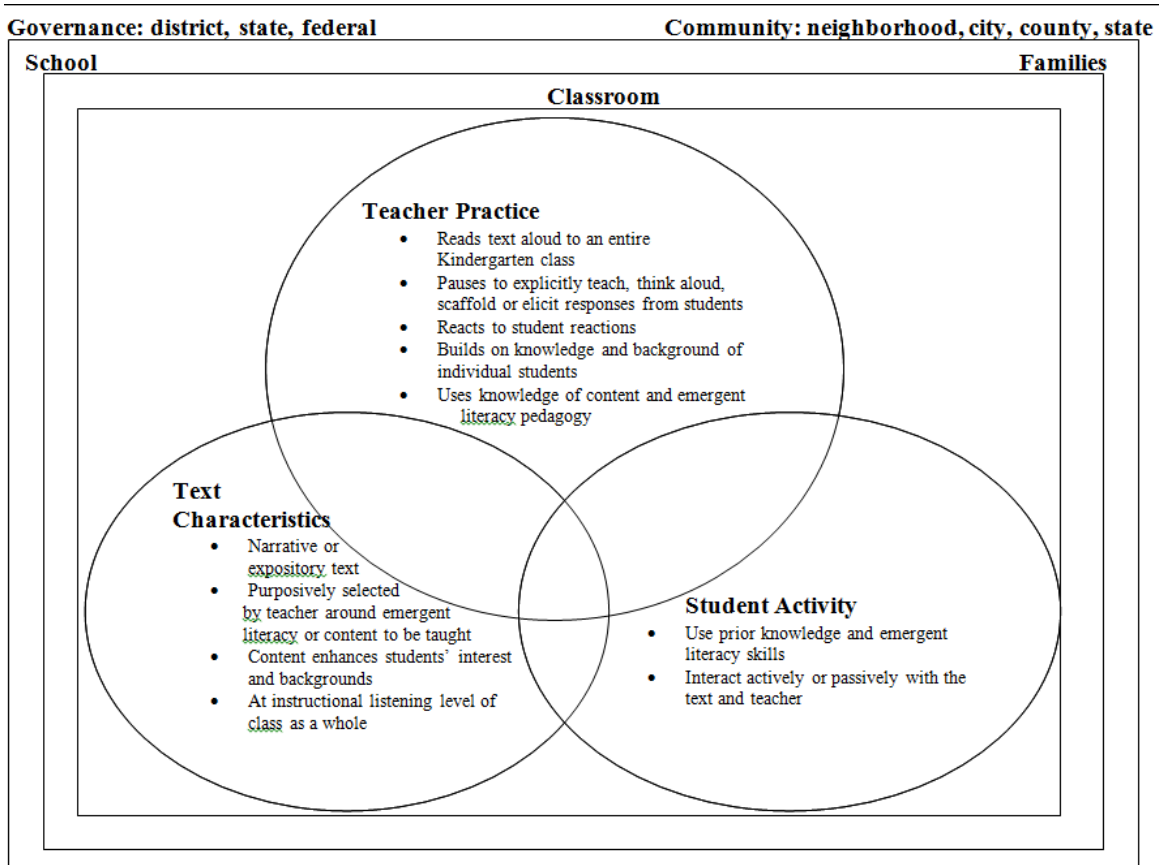
Governance: district, state, federal   **Community: neighborhood, city, county, state**

School   **Families**

Classroom

Teacher Practice
- Reads text aloud to an entire Kindergarten class
- Pauses to explicitly teach, think aloud, scaffold or elicit responses from students
- Reacts to student reactions
- Builds on knowledge and background of individual students
- Uses knowledge of content and emergent literacy pedagogy

Text Characteristics
- Narrative or expository text
- Purposively selected by teacher around emergent literacy or content to be taught
- Content enhances students' interest and backgrounds
- At instructional listening level of class as a whole

Student Activity
- Use prior knowledge and emergent literacy skills
- Interact actively or passively with the text and teacher

Figure 1. Kindergarten whole class interactive reading aloud (CIRA).

and formal teacher interviews. For example, to make sure all teachers coded texts consistently, the researcher coded the texts used at the 16 observations. This information was obtained on the text section of the CIRA Text Log. The CIRA text log was analyzed to see how the participating teachers had coded the texts.

Finally, the texts were shared with the teachers, and then they were asked how they were coded to make sure the coding made at each of the points matched. In all cases, they did match. This correlation can be attributed to the consistent and detailed information given to the participating teachers at the onset of the study in the form of the CIRA text glossaries. The multiple-perspective levels from which to view teacher-student-text involvement in read aloud sessions all combined together to produce a deep descriptive, interactive, and nuanced look at how reading aloud is experienced by emergently literate students.

RESULTS

Strong common patterns across the four teachers emerged and are reported as a collective case study. An N of four for this study did in fact lead to data saturation (Given, 2008). This section addresses the patterns of Teacher Activity. All four teachers conducted their read aloud sessions after what was considered as a traditional kindergarten opening activities. Such activities include interactively reading a large calendar and a chart with the daily plan on it. These activities introduce, teach, and reinforce literacy and math skills. The opening activities lasted approximately 15 to 20 minutes in each of the four classrooms. Two of the teachers conducted their opening activities as soon as the students came into the classroom in the morning. Due to the scheduling of specials (music, media time, physical education, etc.), the other two teachers conducted their read aloud sessions right after students came in from lunch and recess. The read aloud sessions of all four teachers were held after these traditional kindergarten opening activities, whether they occurred in the morning or in the afternoon.

Teacher Activity

The most common code for Teacher Activity, *Evaluation Feedback* accounted for 26% of the codes across the practice of all four teachers. *Evaluation Feedback* is

when the teacher indicates that an answer or student performance is correct, valued, incorrect, or not valued and then provides a reason. The following excerpt illustrated this practice; it is interesting to note that this excerpt is also an example of how the teachers referred to a text's illustrations:

Teacher [*High Order*] You thought Sam I Am was hurting this guy's feelings? Why did you think that?
Student 1 [*Explanation*] He was going after him all the time.
Teacher [*Evaluation Feedback*] Because he was trying to get away. Good! Sam I Am kept bothering him, didn't he? He kept asking him and asking him. In this classroom we would use our debug strategy then, wouldn't we? [*Rhetorical Question*]
Students [*Simple Answer as Group*] Yeah.
Teacher [*High Order*] Let's share one more friend. Student 2 [*uses Student 2s name*], what part are you thinking of?
Student 2 [Alternate Answer] I like the tree.
Teacher [*Evaluation Feedback*, *Elaboration*] You liked the tree? Good! Why did you like that part?
Student 2 [*Explanation*] Because it was so funny.
Teacher [*Evaluation Feedback*] Yes, it was funny! [*Very dramatically*] My favorite part is at the very beginning, when they say, " 'I am Sam, I am Sam. That Sam I am. That Sam I am. [*Rereads and shows pictures*] I do not like that Sam I am!' "[*Scaffolding*] I like that part because it is really funny to read it. I think it is funny to hear, "'Sam I Am, I do not like that Sam I Am'", so many times.

Feedback from a teacher is important to student learning. However, neutral feedback that does not let the student know if they are right or wrong does not move learning forward. Teachers in this study used *Evaluation Feedback* in a quick positive manner to let their students know if they were on the right track; thus a means of moving their students forward to new levels of understanding. *Explains Rules and Procedures* was the second most frequent code across the practices of all the teachers (13%). *Explains Rules and Procedures* is defined as follows:

The teacher explains the rules or procedures for listening to the text or for the follow-up activity after the text has been read. No instruction of literacy skills or content (i.e. Math, Social Studies, Science, etc.) is involved. The following excerpt, illustrated a teacher using *Explains Rules/Procedures* for behavior management:

Teacher [*Explains Rules/Procedures*] Remember; quietly look with your eyes and no talking. Student 1 Magic 5. [*Reads title*]   "Construction Site". Magic 5 on your bottoms; all our friends look up here.

Scaffolding was the third most common code across the

practice of the four teachers (12%). *Scaffolding* is defined as instruction that builds off students' background knowledge and/or models in an interactive manner to move students' thinking forward (usually, a number of exchanges between the teacher and the students). All four teachers appeared to scaffold for the class as a whole, as well as to target certain students to make sure those students understood the text.

In the following exchange between a Teacher and her students, the Teacher had just finished reading *The Three Little Pigs* and was *Scaffolding* the students' understanding of the concept of characters via a whole class discussion. Note how the Teacher does not simply supply information or state what is right or wrong, but rather asks pointed questions to lead the students to their own understanding of the text based on what they already know.

Teacher [*Low Order*] We have been talking about characters [sic] our story. Who were the other characters? [*nods at Student 1 to answer*]
Student 1 [*Simple Answer*] The house, the house!
Teacher [*Evaluation Feedback*] We are not there yet. The house is the setting. Are there any other good characters? There are the three pigs in the story that we just talked about. Student 2? [*Low Order*]
Student 2 [Alternate Answer] The Mom.
Teacher and their Mom, OK? [*pauses to allow for students to think and then asks Low Order question*] Are there any bad characters in this book Alexia? Are there any bad characters in this book?
Student 3 [*Simple Answer*] Yes.
Teacher [*Question Back to Student*] Who is bad in there? [*Pause then asks Low Order question*] Who do you think of when you think of a character who did bad things?
Student 3 [*Simple Answer*] A wolf.
Teacher [*Evaluation Feedback*] So, are there bad characters. Yes, the wolf. He is the bad character in the book. The only bad character.

In the aforementioned passage, *Scaffolding* does not happen in a single exchange. Rather it happens in a series of exchanges between the teacher and students, each building on one another until the teacher is sure the students understand what was read.

The code for *Low Order* was the fourth most prevalent across the practice of all teachers. *Low Order* is defined as follows: The teacher asks a question or presents a problem that can be answered directly from the text or from a student's memory. The excerpt above illustrated the *Low Order* code. With only one exception, the Teacher mostly asked *Low Order* questions about the little pigs to check for and build a basic understanding of the text. She did not ask the students to do any higher order thinking to scaffold their understanding, such as making inferences.

The most common response to student misbehavior (which did not occur very often) was no response at all, as coded by *Redirects Conversation or Continues Reading.* A typical minor behavior issue was students talking out of turn. The most common response from all four teachers was to simply ignore students who were calling out and instead call on students who had their hands raised. The redirection most often involved not simply ignoring the behavior but rather continuing instruction in order to maximize instruction during the read aloud session.

A pervasive code across the practice of the four teachers was *Reads Aloud with Inflection.* Virtually every passage that each teacher read was read with fluency, prosody, expression, and inflection. Each teacher varied the tone, tempo or volume of her voice in order to act out the various characters in a given story. Their voices reflected the emotions the texts conveyed, such as fear, happiness, or sadness. Each of the teachers changed the volume of her voice in order to portray the various moods and emotions of the text or to emphasize a certain point. The quotes throughout this section used to illustrate other characteristics also illustrate reading aloud with inflection and emphasis.

In all cases during the 16 observations, all of the teachers brought attention to the illustrations or photographs in the texts. All four teachers made explicit reference to pictures as they went through the story. As a result, students learned extra-textual material related to the authors, illustrators, and even publishers.

Student activity

 The second group of codes addresses Student Activity. In all cases, the students appeared to be fully engaged during all of the 16 observed sessions. The most pervasive code across all of the observations was *Listens*, defined in the CIRA glossary as, "the majority of the students are listening to or watching the teacher, another student, or other sources of literacy-related information."

Almost all of the student activity coded was considered *On Task*, defined in the CIRA glossary as "students are academically engaged in the topic at hand. This category includes listening to directions." Student activity termed *Play or Socialize/Off Task* was so rare as to be non-existent (only 8 of 1049 codes). Students occasionally discussed non-lesson related topics or were given to socializing, but these activities took place in the spaces between readings or in moments before the teacher would officially bring the class to order.

Another prevalent overt Student Activity code was *Simple Answer* and is defined in the CIRA glossary as: **"**The student gives a short straightforward answer or statement, gives a definition of a term, says I don't know,

says yes or no." This code represented a third of the student activity codes for all teachers. The most common simple answer from students across the observations was a one word utterance - such as Yes or No - or a one or two word answer.

The second most common code of Student Activity across the 16 observations was *On Topic/Out of Turn,* defined as "the student(s) answer is about the text or the topic that the teacher is discussing but the student was not called on." As previously stated, the students were consistently engaged and on task. They reacted to teacher read alouds with excited outbursts, both while the text was being read and while the teacher was pausing to ask questions before, during and after the reading. While these outbursts were on topic because they had to do with the text being read, they were coded off task because the teacher did not call on the student. The following passage is evidence of the code *On Topic/Off Task:*

Teacher [*Reads with Inflection*] "'Wait here and don't leave! [*Raises voice*] And don't move!' said Ruby. 'Dragon shirt', said Max. 'Max', said Ruby. 'After we buy your new pants we will have no [*emphasis on* no] money left over.' "[*Rhetorical Question*] Why do you think Max keeps saying, "Dragon shirt?"
Student [*On Topic/Off Task*] Because he wants a dragon shirt.
Teacher [*Evaluation Feedback*] Because he wants a dragon shirt. [*nods affirmatively and continues to Read with Inflection*].

A code related to *On Topic/Out of Turn* is *Spontaneous Oral Utterance*, and is defined in the CIRA Glossary as "the student(s) spontaneously reacts as the text is being read with an oral utterance" (for example, wow, aaahhh). This code was the third most common across student activity of all observations. The children making sounds of animals in the story; for instance, growling when a bear appears or laughing at an appropriate time while the teacher was reading can characterize these Spontaneous Oral Utterances. The major difference between *Spontaneous Oral Utterance* and *On Topic/Out of Turn* is that a *Spontaneous Oral Utterance* is just a word or two in response to the text that never requires or expects the teacher to respond. On the other hand, *On Topic/Out of Turn* is usually a longer response to the text that often requests or requires the teacher to respond to the student. The following passage offers two examples of *Spontaneous Oral Utterance*:

Teacher [*Reads with Inflection*] "Now bear was very annoyed so he went home and got a hammer and some nails so he could nail his shadow to the ground."
Students [*Spontaneous Oral Utterance*] NO!
Teacher [*Ignores students and continues to Read with*

Inflection] "He hammered and hammered and hammered but no matter how many nails he hammered he couldn't nail [*emphasis on* nail] his shadow down."
Many Students [*sounds of giggling, Spontaneous Oral Utterance*]

The children were so engaged by the story and so sympathetic to the plight of the bear that they spontaneously told the bear not to hammer his shadow to the ground. The teachers did not acknowledge these utterances; however, they were accepted and encouraged by virtue of not being called attention to.

Another code related to both *On Topic/Out of Turn* and *Spontaneous Utterance* is *Choral Reading/Spontaneous.* This response is defined in the CIRA Glossary as: students start to read along with the teacher without being asked to do so. This code accounted for only 3% of the total student activity codes; however, it occurred at least once during each teacher's four observations. This type of activity is powerful working towards the ultimate goal of reading instruction: fluency.

It is interesting to note that the three categories *On Topic/Out of Turn* (17%), *Spontaneous Oral Utterance* (13%) and *Choral Reading/Spontaneous* (3%) accounted for a total of 33% of the total *Student Activity* codes. These three categories are characterized by the students feeling free to spontaneously react to the text being read. Although these teachers were in firm control of their classes, students were encouraged to participate during the reading. These categories along with *Simple Answer* (33%) accounted for a total of 66% of the total *Student Activity* codes.

Text

The third element investigated was the characteristics of the texts the teachers read. Not surprisingly, the most common text structure was narrative at 84%; narrative prose comprised 76% of the texts and narrative poetry 8% of the texts; as narrative stories are typically the kind of text read to young children. Only 26% of the texts were expository in structure. In the past decade, there has been a push to expose young children to more exposition, and the teachers reported in the interviews that they tended to read exposition before Science and Social Studies lessons.

This could explain why there was so little exposition during read aloud sessions. It is interesting to note that the texts read during the study did not often represent the demographics of the students in the classes. For example, all of the fairy tales read during the study were from the western European cannon of children's literature. The same literacy content could have been taught using texts that represented the cultures and backgrounds of the diverse student populations in the study.

Interaction of teacher activity, student activity and text

The symbiotic interaction of teacher activity, student activity, and text is essential in creating a kindergarten classroom practice with the potential to teach literacy skills and other content. While most studies look at these components in isolation, CIRA looks at how they interact in order to give a holistic picture of the read aloud practice. Through this method, several salient patterns emerged.

The strongest pattern across these elements was the four teachers' effective execution of classroom management that yielded completely engaged students. The teachers were so expert at this craft that a casual observer might think classroom management was absent, because there were virtually no behavior problems. All four classrooms were full of children who appeared to be content and fully engaged in what they were doing. This expert classroom management did not look identical in all classrooms, yet was just as effective in all of them. In fact, these four teachers, despite producing similar classroom behaviors, fell along a noticeable continuum, from free-flowing and seemingly un-scripted sessions, to more structured and controlled sessions (Figure 2). Such differences among the teachers' read aloud sessions can be attributed to two distinct factors. One factor is the obviously diverse and multifaceted personalities and backgrounds of the four participating teachers. The other, perhaps more complex, factor is the contextual variations which framed the study.

The highly interactive nature of read aloud sessions meant that student activity and teacher practice influenced performance and retention for all involved students. The salient characteristics of student behavior and student reaction during the read alouds were linked directly to the practice of the teacher. Students were indeed primed for learning, and teachers orchestrated a well-planned CIRA session. Additionally, student receptiveness was dependent on the classroom management and presentational style of the teacher. Teachers who demand good listeners not only encouraged the students to remain engaged, but also managed to have rich discussions about the texts. The sections that follow examine specific characteristics of student activity that relate to learning. Each of these characteristics is an inherent quality of the Student Activity, which the teacher promotes for the benefit of advancing emergent literacy.

A major finding is that all teachers in the study employed positive and transparent classroom management. Moreover, they used scaffolding to improve student comprehension and interaction. Some very interesting patterns emerged around the types of questions asked and answers given. The most common Student Activity Code was *Simple Answer,* meaning that students responded with one or two word utterances or yes or no.
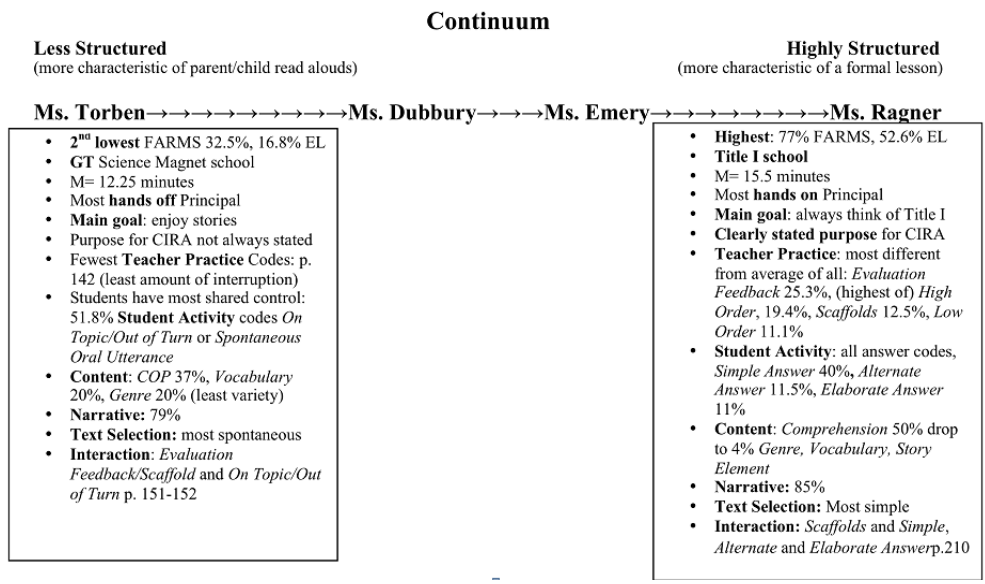
Continuum

Less Structured   Highly Structured
(more characteristic of parent/child read alouds)   (more characteristic of a formal lesson)

Ms. Torben→→→→→→→→→Ms. Dubbury→→→Ms. Emery→→→→→→→→→Ms. Ragner

- **2nd lowest** FARMS 32.5%, 16.8% EL
- **GT** Science Magnet school
- M= 12.25 minutes
- Most **hands off** Principal
- **Main goal**: enjoy stories
- Purpose for CIRA not always stated
- Fewest **Teacher Practice** Codes: p. 142 (least amount of interruption)
- Students have most shared control: 51.8% **Student Activity** codes *On Topic/Out of Turn* or *Spontaneous Oral Utterance*
- **Content**: *COP* 37%, *Vocabulary* 20%, *Genre* 20% (least variety)
- **Narrative:** 79%
- **Text Selection:** most spontaneous
- **Interaction**: *Evaluation Feedback/Scaffold* and *On Topic/Out of Turn* p. 151-152

- **Highest**: 77% FARMS, 52.6% EL
- **Title I school**
- M= 15.5 minutes
- Most **hands on** Principal
- **Main goal**: always think of Title I
- **Clearly stated purpose** for CIRA
- **Teacher Practice**: most different from average of all: *Evaluation Feedback* 25.3%, (highest of) *High Order*, 19.4%, *Scaffolds* 12.5%, *Low Order* 11.1%
- **Student Activity**: all answer codes, *Simple Answer* 40%, *Alternate Answer* 11.5%, *Elaborate Answer* 11%
- **Content**: *Comprehension* 50% drop to 4% *Genre, Vocabulary, Story Element*
- **Narrative:** 85%
- **Text Selection:** Most simple
- **Interaction:** *Scaffolds* and *Simple, Alternate* and *Elaborate Answer* p.210

Figure 2. Kindergarten class interaction reading aloud (CIRA) major findings within teacher practice individual teacher case studies.

This is not surprising because a common code of Teacher Activity was *Poses Low Order Task/Problem/ Question; Evaluation Feedback*. It follows that a common response to a *Low Order Question* is a *Simple Answer.* The teachers did use these simple answers as opportunities for scaffolding as the teacher almost always evaluated the response coded as *Evaluation Feedback*. It is interesting to consider what would happen if the teachers had posed higher-order questions more often. Would the students have responded with more complex answers? The teachers already had excellent control of the interactive read aloud sessions. Asking more rigorous questions and requiring more complex answers from the students may have the potential to make these sessions more meaningful learning environments.

Students in the primary grades, particularly kinder- garten, can read only very simple texts independently and therefore depend on the teacher to read complex texts to them. Even with regular classroom instruction and support, students will need help with texts that require critical thinking and analysis to fully understand them. Teachers in this study modeled how to read and understand complex texts by reading aloud in order to can show students how to comprehend texts that would normally be too difficult for them to read independently. By effectively using teacher scaffolding to create a warm, personable, and safe verbal interaction with a knowledgeable other, read alouds will help kindergarten students develop increasingly sophisticated reading skills and improve their ability to access complex texts.

Examples from this study use texts well above the students' individual reading levels, thus giving kindergarteners access to difficult concepts via a developmentally appropriate means. That being said, teachers need to be careful not to 'trap' their students by asking them only low order questions as evidenced in this study, especially those in lower SES schools and/or English Language Learners. Expectations need to be elevated for all students, and with proper support, all students can meet with success in mastering emergent literacy skills.

Another interesting finding in this study is the type of texts the teachers chose to read. Typically they, chose texts with a narrative text structure. In addition to expanding the emergent literacy skills of kindergarteners through discussion, teachers also need to make wise-and- varied-choices in the selection of read aloud texts. Thus, the text part of the CIRA model supports the shifts in the type of text used as tools for literacy instruction. Abundant evidence exists which suggests that it is necessary for children to be exposed to a wide variety of text genres and structures in order for them to be able to comprehend these various genres and structures. Due to the more complex structure of expository text and the potential rigor of the informational content, it is possible that the interactions between teacher, student, and text will become more sophisticated and rigorous.

This study had many facets; thus, the direction for future research could take many directions. A next step would be to use the CIRA model as a lens to

systematically explore interactive read aloud sessions in a wider variety of schools, with a wider variety of teachers, and with different types of texts. The CIRA model could act as a consistent lens to understand the changing variables of teacher, student and/or text. One approach could be to replicate this study in a cross section of schools representing high and middle SES schools and compare the interactions in the CIRA model to those found in this current study of lower SES schools. These additional studies would explore and illuminate the differences, if any, in the interaction between Teacher Practice, Student Activity and Texts read. At that point, a more complete, holistic understanding of interactive read aloud sessions in would be achieved, thereby making literacy instruction more effective for all students.

Kindergarten teachers in this study spent an average of 15 min (per day) reading aloud to their students. This is a large portion of the instructional day, especially when added up over the course of a year (45 h). Interactive read aloud sessions need to be examined more fully so potential learning opportunities can be maximized, particularly for students who are at risk of becoming below-grade readers. These children especially cannot afford to spend their valuable instructional time in ineffective and counterproductive learning situations. Teachers sometimes do not maximize instruction and substantial valuable learning time is wasted. Teachers need to find ways to use time more effectively and efficiently, both in the area of classroom management and in the actual execution of lessons. In this study, much was learned to illuminate the practice of interactive reading aloud in the hands of experienced teachers. Read aloud sessions based on the CIRA model could be an integral part of a kindergarten emergent literacy program because such sessions are a prime example of how instructional time can be maximized in a variety of ways.

Finally, one of the most interesting patterns, which emerged was the interactive patterns between the teacher, students, and texts. Predominately, it was found that teachers used narrative texts and interacted with students largely through '*simple questions*' and '*simple answer*' strategies. Expository text may in fact yield more opportunities for higher-order thinking based on a tendency of exposition to provide more rigorous content and a more complex structure than narrative text.

This study, using CIRA as a model, provides a way to assess interactive read aloud sessions in kindergarten. Teachers who employ interactive read aloud sessions that align with the CIRA model will average 15 min every day not simply reading a book, but instead also teaching emergent literacy skills, as well as content, in developmentally appropriate ways. Additionally, students who participate in interactive read aloud sessions modeled after CIRA will be actively engaged in a literacy activity that has the potential to maximize their literacy learning. This study also provides a model researchers can use to examine the elements of read aloud sessions and the types of learning that occur.

Findings shed light on whole-class kindergarten interactive reading aloud sessions in a novel way because the study specifically looked at the interaction of the teacher's artful and thoughtful practice, the students' productive engagement, and the text's rich possibilities intertwined together and not as disconnected pieces.

Conflict of Interests

The authors have not declared any conflict of interests.

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