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Articles

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Before you submit, please make sure your paper meets some basic academic standards, which include proper English. Some articles will be selected from the numerous papers that have been presented at the various annual international academic conferences organized by the different divisions and units of the Athens Institute for Education and Research.

The plethora of papers presented every year will enable the editorial board of each journal to select the best ones, and in so doing, to produce a quality academic journal. In addition to papers presented, ATINER encourages the independent submission of papers to be evaluated for publication.

The current issue of the Athens Journal of Education (AJE) is the first issue of the seventh volume (2020). The reader will notice some changes compared with the previous issues, which I hope is an improvement.

Gregory T. Papanikos, President
Athens Institute for Education and Research

Athens Institute for Education and Research

A World Association of Academics and Researchers

22nd Annual International Conference on Education
18-21 May 2020, Athens, Greece

The Education Unit of ATINER organizes its **22nd Annual International Conference on Education, 18-21 May 2020, Athens, Greece** sponsored by the Athens Journal of Education. The aim of the conference is to bring together scholars and students of education and other related disciplines. You may participate as stream leader, presenter of one paper, chair a session or observer. Papers (in English) from all areas of education are welcome. Please submit a proposal using the form available (https://www.atiner.gr/2020/FORM-EDU.doc).

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- Abstract Submission: **20 January 2020**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **20 April 2020**

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- Greek Night Entertainment (This is the official dinner of the conference)
- Athens Sightseeing: Old and New-An Educational Urban Walk
- Social Dinner
- Mycenae Visit
- Exploration of the Aegean Islands
- Delphi Visit
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Promising Practices in Coaching Co-taught Preservice Clinical Experiences[1]

By Toni S. Strieker[*], Woong Lim[†], David Rosengrant[‡] & Marcia Wright[+]

In 2010, the National Council for Accreditation of Teacher Education (NCATE) called for colleges and universities to "turn teacher education upside down" (pg. 2) and focus on clinical experiences, rather than coursework. This charge resulted in major shifts in teacher education programs in the USA as colleges and universities forged new partnerships to create yearlong clinical experiences that included co-teaching and coaching. In 2018, the American Association of Colleges for Teacher Education (AACTE) Commission on Clinical Experiences recognized and described the mutual benefits of expanding these partnerships between schools and universities to include various forms of collaboration, co-teaching and coaching. While these partnerships are increasing in number, little is known about the efficacy of the specific coaching approaches and practices employed in the co-taught classroom. This self-study examined the communication and behavioral approaches of 13 co-teaching coaches who collaborated with 39 teacher candidates enrolled in yearlong, co-taught P-12 clinical experiences. The co-teaching coaches attended up to four sessions of professional learning on co-teaching and coaching. Basic statistics were used to determine the demographics, the content of the coaching conversations, and preferred coaching approaches. The main data sources were the coaches' resumes, their reflections on goal-setting sessions, observation reports, and surveys on their daily coaching activities. Results indicated that effective coaches engaged in collaborative dialogue that moved candidates to self-directed learning. Similarly, these results described the pedagogical practices of effective coaches in terms of goal-setting with the candidates, basic mentoring, and demonstration teaching.

Keywords: Teacher Education Reform, Clinical Experiences, Pre-service Co-teaching, Student Teaching, Instructional Coaching

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[1]The first author and researcher presented the findings at the 20th Annual International Conference on Education of the Athens Institute for Education and Research in Athens, Greece on May 21, 2018. At the time of this conference, Drs. Toni Strieker and David Rosengrant are coaching 1st and 2nd year teachers whose induction is funded by the Woodrow Wilson Georgia Teaching Fellowship, a private foundation in Washington, D.C. committed to preparing high quality STEM teachers to work in America's high-poverty high schools

In 2005, the Organization for Economic Co-operation and Development (OECD) commissioned a study on attracting, developing, and retaining teachers in 25 countries. According to these authors, in an effort to create a high social and economic order, countries around the world are seeking to improve their schools. Teachers, as the most expensive and significant resource in schools, are central to all school improvement initiatives. Furthermore, these authors report, "Improving the efficiency and equity of school depends in large measure on ensuring that competent people want to work as teachers, that their teaching is of high quality, and that all students have access to high quality teaching" (OECD, 2005, p. 1). More recently, Lewin (2011) reported that improvements in teacher effectiveness in the United States have resulted in changes to the accreditation standards (Council for the Accreditation of Educator Preparation [CAEP], 2015), particularly in terms of restructuring clinical experiences by means of school-university partnerships.

In response to the international call, faculty members representing various teacher education programs formed interdisciplinary teams to design, develop, pilot and evaluate new approaches to clinical experiences (Strieker et al., 2017; Williams, Gray, & Stockdale, 2012). These efforts resulted in a set of new approaches were aligned with the common variables of highly effective teacher education programs reported by Darling-Hammond (2006), including a common vision of teaching and learning, carefully crafted field experiences, theorization and justification of practice, focus upon the needs of the students, reflection on active pedagogy, engagement of collaborating teachers (CTs) as lifelong learners, and collaboration with their professional partners. In terms of positionality, the current study represents one investigation conducted as part of the larger research agenda of the interdisciplinary teams described above.

Over the past decade, numerous authors (Bacharach et al. 2010; Badiali & Titus, 2010) have described effective co-teaching in pre-service teacher education. Yet, there is limited research on the characteristics and approaches of instructional coaches who forge a partnership with the collaborating teacher to support the teacher candidate during co-taught clinical experiences. Over the past ten years, researchers at our institution have explored various aspects of preservice co-teaching, particularly in terms of the benefits of co-teaching (Heckert, Strieker, & Shaheen, 2013), the content of the collaborative and reflective dialogue (Strieker, Adams, Lim, & Wright, 2017), and the goals of the teacher candidates engaged in co-teaching coaching (Strieker, Shaheen, Hubbard, Digiovanni, & Lim, 2014). The current study explores the communication and behavioral approaches of co-teaching coaches situated in a collegial and reflective model of coaching, developed by, and for, teacher educators, along with their professional colleagues in P-12 schools. Furthermore, we examine the practices of 13 co-teaching coaches who are responsible for coaching 39 teacher candidates (assigned to 39 collaborating teachers) during a yearlong, co-taught P-12 teaching experience. Specifically, the following research questions guided our study:

1. What are the characteristics of highly effective co-teaching coaches in terms of their years of experience, education, coaching approaches and practices?
2. What is the content of the dialogue between the coaches, the teacher candidates and the CTs as it relates to co-teaching?
3. What are the daily practices of highly effective coaches?

Theoretical Framework, Conceptual Language & Review of Literature

The theoretical framework for this study draws heavily from activity theory (Saari & Miettinen, 2001) and positioning theory (Harré & van Langenhove, 1999). Both theories address how interpersonal communication and relationships reflect the roles assumed by individuals in social settings. According to activity theorists (Saari et al., 2001; Engestrom, 2000), all human activity is fundamentally goal-driven; is mediated by culture and language, rules and routines, materials and situation; and results in tangible outcomes. When applied to clinical experiences, the CTs and coaches assist candidates in achieving their goals by making decisions drawn from their own backgrounds of experience, knowledge, skill sets, *as well as* the situational demands and availability ofresources within the school. For example, the CTs assume responsibilities for mentoring the teacher candidatesand mediate their learning. Co-teaching coaches, on the other hand, facilitate the candidate's self-direction in his or her own professional learning. During the yearlong clinical experience, the coach and CT assume these influential roles and support the candidate's induction into the teaching profession.

To augment activity theory, we selected positioning theory (Harré et al., 1999), which describes position as a "…conceptual apparatus that allows for social constructionist theorizing based on a dynamic analysis of conversations and discourses" (p. 2). Thus, this theoretical approach provides a framework for understanding how individuals on a team define their roles and responsibilities in order to be effective educators (Bullough & Draper, 2004).

Through this dynamic discourse, educators engage in high levels of co-generative dialogue which requires them to use their knowledge and experience to analyze and describe their situation, to relate their personal stories, and ultimately, to solve the complex problems of practice that occur everyday in America's classrooms (Roth, 2004; Tobin & Roth, 2010).

We begin to fully understand coaching and co-generative dialogue as an ever-dynamic and changing process (Roth & Tobin, 2005) when we account for the history, culture and language of the school as well as the interpersonal interactions among the cooperating teacher, the teacher candidate and the co-teaching coach. According to Rogoff (1990), learning is not only personal; it is also interpersonal and situational. In 1993, Brandt, Farmer, and Buckmaster described a fluid process in which the mentor facilitates the learning process of a novice by scaffolding support, demonstrating and modeling procedures, and guiding the thought process. The novice, in turn, observes, approximates, reflects, and generalizes new knowledge and skills. In the world of P-12 education, not only do these mentors

facilitate the professional practices of novice teachers, they also provide the vehicle for the acculturation of these new teachers to the school community.

Literature Review

Instructional coaching. Classroom coaching is a generic term for a number of practices that include Instructional Coaching (Knight, 2007), Differentiated Coaching (Kise, 2006, Literacy Coaching (Stover, Kissel, Haag, & Shoniker, 2011), Content Coaching (Tschannen-Moran & Tschannen, 2011) and Co-teaching Coaching (Strieker, Shaheen, Hubbard, Digiovanni, & Lim, 2014). In 2012, Knight and van Nieuwerburgh reported that instructional coaching positively impacted student achievement in P-12 schools.

According to Bearwald (2011) and Knight (2007), effective coaching is dependent upon interpersonal relationships and dialogue guided by the coach's ability to ask critical questions, rather than to simply offer solutions or make recommendations. In doing so, the coach facilitates a dialogue where teacher candidates and CTs have the opportunity to theorize the lesson and seek to understand the theory-to-practice (or practice-to-theory) implications as they co-generate ideas for improving teaching and learning (Roth, Tobin, Camambo, & Dalland, 2004). Thus, the interpersonal communication between the teacher candidate, the co-teaching coach and the CT drives the effectiveness of all concerned.

In our attempt to apply the principles and practices of coaching in P-12 schools to university preparation of P-12 teachers, we adopted Knight's (2007) Partnership Principles as the common language and conceptual framework for developing substantive interpersonal communication and substantive relationships to support collaboration, co-teaching, and co-generative dialogue. The Partnership Principles are: equality, choice, voice, dialogue, reflection, praxis, and reciprocity. Within the context of a co-taught clinical experience, *equality* implies that even though the candidates do not yet hold state teacher certification, their knowledge, skills, experience, and contributions hold equal value to those of the CT. Furthermore, each co-teacher has *voice* and *choice* in decision-making; therefore, the candidates' voices are heard throughout the cycle of co-teaching, including co-reflection and co-generative dialogue (Strieker et al., 2014). After the candidate's monthly co-teaching observations, the co-teaching coach, CT, and teacher candidate form a triad and engage in *co-generative dialogue* to discuss their perceptions of the lesson observed and resolve complex problems of practice. The fluid nature of the approach supports the candidate in applying the knowledge and skills learned in university coursework to the realities of the classroom (*praxis*).

Interpersonal communication. The importance of the interpersonal communication and co-generative dialogue among members of the triad (e.g., co-teaching coach, teacher candidate, and CT) cannot be underestimated. According to Hart (2018), communication among members of the triad form triatic and dyadic patterns at varying levels of frequency during the clinical experience. In addition to the frequency of patterns of communication among various groupings within the triad, the content of communication is also varied. The teacher

candidates and their CTs often engaged in co-generative dialogue on complex problems of classroom management, differentiated instruction and assessment (Strieker, et al., 2014). Similarly, Valencia, Martin, Place & Grossman (2009) found that candidates and their university discussed discipline-specific content, pedagogy and theory. In terms of influence on the development of teacher candidate efficacy, Lu (2007) described the CT as more influential than the university coach due to his or her daily interactions, observations and feedback to the candidate. In 2006, Baxter, Braithwaite, and Bryant described eight specific communication patterns among or between people who are engaged in triads on a regular basis in a traditional student teaching model. The communication patterns vary from the dysfunctional Closed Triad, which indicates no or ineffective communication, to the highly functional Open Triad, which indicates that communication is positive and flowing between and among all members of the group. Also, Baxter, et al. (2006) described functional dyads that dominate triads including the following: a) field-based triads dominated by CT and candidate; b) university-coalition triads dominated by university liaisons and candidate; and c) expert-coalition triads dominated by CT and university liaison. Finally, the researchers identified dyads positively linked to one member of the triad (CT, candidate or co-teaching coach) with another member. Finally, Elrod (2017) reported that open, reflective dialogue among all members of the triad positively impacted the professional and personal development of the candidate.

It is important to note that the literature is also replete with reports of interpersonal conflicts among members of the triads in traditional student teaching experiences. According to Rhoads, Samkoff, and Weber (2013), several types of tension commonly occur between the CT and the teacher candidate in traditional student teaching that often results from the CT's hesitation to shift power in the classroom to the candidate. This hesitation creates the CT's resistance to the candidate's selection of teaching methods and topics of content. Furthermore, hesitant CTs often challenge the candidate's capacity to manage their time, student behavior, and student learning. Finally, many CTs display the tendency to undermine their candidate by openly interrupting and/or disagreeing while the candidate is teaching.

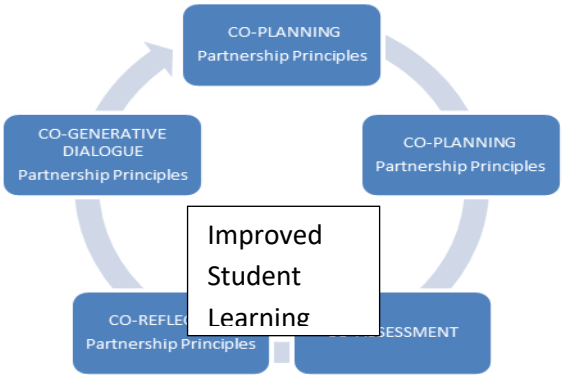
Equally troubling are the reports of candidates being "stuck in the middle" between the university liaison and their CT in traditional student teaching. According to Bullough and Draper (2004), conflicting perceptions of candidate performance, mixed messages, and power struggles are also a source of conflict among members of the triad. All of these situations can and do result in ongoing difficulties in the interpersonal relationships between the candidate and the CT.

The literature from teacher education sources concerning interpersonal communication, dialogue, and co-teaching describes patterns and relationships that exist among the candidate, CT and university representative (Bullough et al., 2004; Rhodes, et al., 2013; Roth, et al., 2005; Strieker, Adams, Lim, & Wright, 2017). Very few, if any, focus on these relationships when the triad is inclusive of an instructional coach. Furthermore, there are limited, if any, reports on the practices of instructional co-teaching coaches in clinical settings in teacher education. The fact that so few studies of this nature regarding coaching in teacher education are

available underscores the need for the current study.

Theoretical, Conceptual & Operational Model of Pre-service Co-teaching and Coaching

Figure 1. Cycle of Pre-service Co-teaching



The theoretical, conceptual and operational model of pre-service co-teaching and coaching that was employed for the current study was originally reported by Strieker, et al., 2017. The model was designed and developed to mirror the cycle of teaching recommended by AACTE (2013) (see Figure 1). With an eye on improved student learning, the co-teachers engaged in an ongoing cycle of co-planning, co-instruction, co-assessment and co-reflection and co-generative dialogue. During the co-planning sessions, the co-teachers discussed curriculum standards, classroom management, classroom rules and routines, differentiated instruction, particularly in terms of how to use co-teaching to support equitable instruction. During co-instruction, the teacher candidate literally taught at the elbow (Roth & Tobin, 2005) of the CT which provided ongoing opportunities for demonstration teaching. Also, during co-instruction, the co-teachers employed virtually all of the co-teaching structures offered by Cook and Friend (1995) and assisted students in making smooth transitions between large and small group activities. Finally, the co-teachers engaged in ongoing co-assessment and co-reflection on student performance. To that end, the co-teachers were able to perform sophisticated classroom assessments including, benchmarking student behavior against classroom norms, conducting pre-assessments of prior knowledge, performance monitoring, formative and summative assessments.

The observations and feedback sessions conducted by the coaches focused on activities designated by the teacher candidate, the CT and the coach. The co-teaching coaches had the flexibility to address any and all aspects of the co-teaching cycle, including; but not restricted to, planning and implementation of research-based instructional strategies, co-teaching structures and approaches, formative and summative assessments, problem-solving approaches, etc. Coaches often facilitated the reflective dialogue that focused upon the candidate's plan for performance improvement.

Definitions and Terms

Within the fields of instructional coaching and clinical experiences in teacher education, there is a multiplicity of terms that may cause confusion to the readers; therefore, we have provided definitions of terms that are pertinent to this investigation. Because the current research on clinical practice in teacher education was conducted as part of the multi-year, multi-phase research agendas of the first and second authors, several of the definitions were derived from previous research.

1. *Pre-service Co-teaching* was originally defined by Heck, Bacharach, Mann, and Ofstedal (2005) as "two teachers (a cooperating teacher and a teacher candidate) working together with groups of students; sharing the planning, organization, delivery and assessment of instruction, as well as, the physical space" (n.p.).
2. *Co-teaching Coaching* is a specialized form of instructional coaching where the coach guides the teacher candidate and the CT who co-teach one or more groups of students during the candidate's clinical experience. Co-teaching coaching is a form of job-embedded professional development that relies upon virtual or real-time classroom observations and feedback. The goals of coaching are specific to the individuals and target improved performance for teacher candidate as well as their students. In some instances, the performance improvement goals may address improved collaboration and co-teaching with the CT.
3. The *Communication and Behavioral Coaching Approaches* used by the coaches in this study were derived from the previous work of Glickman, Gordan, and Ross-Gordan (2014). Glickman, et al., studied the communication of supervisors who adjusted their approaches based upon the developmental needs of their teachers. Glickman's 2014 rendition of supervisory roles ranged from expert to facilitative and the approaches ranged from Direct Control (DC) and/or Direct Informative (DI) to Collaborative (Col) and Non Directive (ND). While there is some overlap between the role and approaches used by our co-teaching coaches and developmental supervisors, our coaches maintained a no evaluative stance when working with the teacher candidates and CTs. Nonetheless, it was not uncommon for the candidates to request direct guidance from their coach and/or CT on implementation of specific strategies. Our coaches had the flexibility to demonstrate or explain specific teaching strategies, behavioral interventions, etc. On rare occasions when the coach was forced to take control of the situation, the candidate was immediately referred to the university supervisor for evaluation and feedback.
4. *Co-generative Dialogue* is a form of "structured discourse in which teachers and students engage in a collaborative effort to help identify and implement positive changes in a teacher's classroom teaching and learning practices" (Martin, 2006, p. 694).
4. *Partnership Principles* were originally developed by Knight (2007) who identified them as central to developing substantive interpersonal

communication and substantive relationships to support collaboration, mentoring and other forms of collegial practice in education.

5. *University Liaisons* are university-based teacher educators (AACTE, 2018). For the purposes of this study, they are co-teaching coaches who may or may not also be employed as teacher education faculty.

Method

Self-Study in Teacher Education Research

The current investigation responded to Zeichner's (2007) call for self-study in teacher education by situating the present study in the larger context of research at our institution on the pedagogical practices of co-teaching coaches of practicing teacher candidates, enrolled in yearlong, co-taught clinical experiences. Our study was essentially a case study that used a dynamic action process case that allowed us to improve our program as the analysis unfolded. We followed this research tradition because it provided an effective tool for conducting systematic inquiry and program improvement.

Program Context

The co-teaching coaching programs and practices examined in this study were designed, developed, and analyzed at a state university, located in the metropolitan area of a large city in the southern region of the United States. The educator preparation program at this university graduates approximately 900 prospective teachers who complete initial certification programs in early childhood, elementary, middle and secondary education, special education, and instructional technology. Of those who graduated in 2015, approximately 82% self-reported as white (non-Hispanic), 11% as black (non-Hispanic), 3% as Hispanic, 1% as Asian, 2% as multi-racial, and 2% undeclared. The teacher education unit is fully accredited by CAEP as well as by national professional associations.

Informants in the Study

All of the informants met the university guidelines for co-teaching coaches in that they had taught a minimum of four years and were certified in the content areas in which they coached, e.g., elementary, social studies, math, English, or physics. The cadre of co-teaching coaches was comprised of thirteen females and two males. Based upon their self-reports, four were retired school principals, twelve were retired teachers, and one was a member of the university faculty. All of the coaches had either engaged in co-teaching during their careers as teachers or as administrators who evaluated the co-teachers in their schools. Thirteen were Caucasian, one was Hispanic, and one was African American. While most of the coaches held a master's degree, one-third held doctoral degrees. The coaches reported a range of teaching experience from four to twenty-seven years, with an

average of fifteen. The coaches reported less experience in actual university coaching. Twelve of the fifteen were in their first year of coaching. Of the three individuals who reported experience in university coaching, two people had two years and one person had three.

The co-teaching coaches were assigned to schools affiliated with one metropolitan school district that had a formal district-university agreement. According to the agreement, the district would host yearlong, co-taught clinical experiences in teacher education. To that end, during their senior year, teacher candidates were assigned to a qualified collaborating teacher, a university supervisor and a co-teaching coach. The co-teaching coaches who participated in this study were assigned to thirty-nine pairs of teacher candidates (along with their CTs) who were employed or interned in one of four elementary schools, two middle schools or three high schools in the same school district.

Professional Learning Seminars for Teacher Candidates, CTs and Coaches

The district agreed to assign our teacher candidates to CTs who would not only co-teach the entire year, but who would participate in professional development on how to use co-teaching, mentoring and instructional coaching. In order to build relationships and meaningful partnerships, the university agreed to send all of the co-teaching coaches who were assigned to the teacher candidates and CTs to the same seminars. The topics of professional learning included, but were not restricted to, the following: A Partnership Approach to Pre-service Co-teaching; Foundations in Instructional Coaching; Coaching Classroom Management; Communication and Behavior Approaches to Coaching; Differentiated Coaching and Instruction. In addition, each co-teaching coach agreed to attend monthly sessions that specifically addressed research-based practices in coaching, facilitation, communication, and partnership development.

Data Sources and Data Analysis Procedures

The co-teaching coaches were responsible for submitting monthly reports, protocols, and reflections as well as brief surveys on their monthly activities. The data consisted of artifacts gleaned from the coaches' monthly reporting as well as attendance records from the seminars. Our coaches'monthly reporting typically included their completed observation reports, GROW protocol (adapted from Whitemore, 2002) and a monthly coaching co-teaching survey on a web-based data repository (see Appendix 1). Regular submission of this information provided a set of qualitative and quantitative data for our analysis.

Survey of effective practices of co-teaching coaches. To determine the practices of our co-teaching coaches, we developed a survey based upon the work of Knight (2008) that defined effective practices in mentoring, coaching and collaboration (see Appendix 1). The survey was designed to determine the frequencies that coaches engaged in research-based coaching practices, including: (a) candidate goal-setting; (b) instructional coaching on the "big four" instructional practices (e.g., co-teaching only, differentiated instruction, formative assessment,

and classroom management); (c) coaching other instructional practices; (d) benchmarking student engagement; coaching on curriculum or content specific topics; (e) basic mentoring; (f) development of partnerships with CT; (g) demonstration teaching; (h) recommendations of resources; and/or (i) facilitation of co-planning. The surveys were developed by a multi-disciplinary team of faculty members who oversaw coaching in their program areas, e.g., elementary, middle or secondary programs (see Appendix 1).

Quantification of coaching practices and effectiveness. Our initial method to quantify our coaches' practices relied on the university data base for recruitment, professional development and accountability of our coaches. In an effort to evaluate the effectiveness of our coaches, particularly in terms of their collaboration with our candidates and CTs, we developed a simple mathematical formula. The formula derived from our study used a composite score (max. 14 points) totaled by adding 4 maximum points for co-teaching coaching approaches, 5 maximum points for content, and 5 maximum points for the indicators of contribution. To that end, co-teaching coaching approaches were defined as DC, DI, Coll and ND. The content of the content of the discussion among the coach, the collaborating teacher and the teacher candidate. The topics of conversation were categorized under five of the key elements of the co-teaching cycle, including the Partnership Principles (PP), Co-Planning (P), Co-Instruction (I), Co-Assessment (A), and Co-Reflection (R) (see Figure 1. for descriptions of content of discussions.)

To determine coaching approach and content, the numbers indicate whether we found evidence (i.e., 1) or not (i.e., 0) of implementing an indicated method or content on the GROW protocol. The Collaboration & Contribution score included 3 points and indicates how the contribution of teacher candidates and/or CTs was articulated on the GROW protocol– i.e., never noted (0 point), rarely noted (1 point), frequently noted (2 points), and always noted (3 points) respectively. Additionally, coaches received one point when there was unsolicited positive feedback from CTs or teacher candidates. A negative point was applied when the feedback was negative and a zero point was applied if there was no feedback.

The scores to represent the levels of educational degree were: Bachelor (1), Masters (2), and Doctorate (3). The Composite Score was derived from the total of Approach Score, Content Score, and the Collaboration & Contribution Score. Table 1 illustrates the breakdown of composite scores for each co-teaching coach.

Results

Quantitative Analysis

The Pearson correlation coefficient was used to measure whether a positive or negative linear relationship occurred between the scores and the variables indicating experience, attendance, and education. We report that there was no statistically significant correlation between the scores and years of experience either teaching or administering programs, attendance at professional development,

and/or determination of the highest year of degree obtained (see Table 1).

Calculation of Composite Scores and Ranking

As noted above, formula derived from our study used a composite score (max. 14 points) totaled by adding 4 maximum points for co-teaching coaching approaches, 5 maximum points for content, and 5 maximum points for the indicators of contribution. Based upon these calculations, the composite scores of the co-teaching coaches were ranked from low (+1) to high (+11). The composite scores were then placed in three categories including, (a) Effective (8-11); (b) Emerging (6-7); and (c) Needs Development (5 and below). For our purposes, effective coaches were those who provided evidence of using facilitative methods and whose candidates emerged as self-directed learners. Coaches in need of development were those who provided evidence of maintaining their role of expert and whose candidates provided little evidence of self-directed learning. Table 2 describes the composite scores for each coach.

Table 1. Demographic Co-teaching Coaches

No	Coaching Placement	Years of Experience			Education			Coaching Approaches				Content of Coaching					Indicators of Contributions		Collaboration & Contribution Score	Composite Score
		Coaching	Administration	Teaching	Degree	Cert	Hrs of PD	DC	DI	Collab	Non Direct	Partnership Principles	Co-Plan	Co-Instruct	Co-Assess	Co-Reflect	Teacher Candidate	Cooperating Teacher		
1	Elem	3	27	13	2	Elem	4	0	1	0	1	1	1	1	0	1	1	1	3	11
2	Elem	1	0	27	2	Elem	2	0	0	1	1	1	1	1	1	1	0	0	3	10
3	Elem	2	15	15	2	Elem	3	0	1	1	1	1	0	1	0	1	1	0	3	10
4	Middle	1	0	8	1	Middle	2	0	0	1	1	1	1	1	1	1	0	0	1	8
5	Secondary	1	0	4	3	Secondary	1	0	0	0	1	1	1	1	1	1	1	0	1	8
6	Secondary	1	5	7	3	Secondary	1	0	0	0	1	1	1	1	0	1	0	1	1	7
7	Elem	1	10	20	1	Elem	2	0	1	0	0	0	1	1	0	0	1	1	2	7
8	Elem	1	0	37	2	Elem	2	0	1	0	1	1	1	1	0	0	0	0	1	6
9	Secondary	1	0	25	1	Secondary	2	1	1	0	0	1	1	1	0	1	-1	-1	2	6
10	Elem	1	0	30	1	Elem	2	0	1	1	0	0	1	1	0	1	-1	0	2	6
11	Secondary	1	0	6	1	Secondary	1	0	0	0	1	1	1	1	1	0	0	0	1	6
12	Elem	1	8	8	3	Elem	2	0	0	1	0	1	1	1	1	1	-1	-1	1	5
13	Middle	2	0	20	2	Middle	4	1	1	0	0	0	1	1	0	0	0	0	1	5
14	Middle	1	10	6	2	Middle	2	0	0	1	0	1	0	1	0	0	0	0	1	4
15	Secondary	1	4	7	1	Secondary	2	0	0	0	0	0	0	1	0	0	0	0	0	1

One option to test the reliability of our formula as a performance metric was to compare the results with those of an internal evaluation measure. If the two measures drew similar conclusions, the reliability was established. Thus, once the composite scores were derived, the co-teaching coaches' composite scores were rank-ordered from high to low. The scores and ranking were then shared with the coordinators of the coaching program who compared these results their own with internal evaluation of the coaches. Based upon those comparisons, the coordinators verified the ranking.

Discussion

Characteristics of Effective Co-teaching Coaches

Based upon these results, there were five coaches whose scores attained the rank of Effective (see Table 1). Among them, three coached in elementary schools, one in middle school social studies classrooms, and one in high school mathematics classrooms. The effective coaches distinguished themselves with strong indicators of collaboration, including facilitation of dialogue with contributions of the teacher candidates and the CTs. Further, the effective coaches provided evidence of using Coll and ND coaching approaches. For example, one high school coach noted, "As a team, we all agreed on the same coaching goal to give Sarah (the candidate) increased opportunities for feedback on her instructional decisions and efforts."

Furthermore, all five coaches who were designated as effective reported that they had intentionally facilitated dialogue used Partnership Principles (e.g. voice, choice, etc.) to assist the CT and teacher candidates to define and develop positive and productive working relationships. For example, the high school math coach reported, "Sarah and CT appear to have a good working rapport. They claim to have similar teaching philosophies and beliefs." Similarly, all five coaches described their facilitation of co-generative dialogue where the candidates revealed the self-directed nature of their learning. For example, the middle school coach stated,

> "During our reflective dialogue, the candidate expressed that he felt his (coaching) goals were met for this particular lesson as he continues to do well with all of his classes. He is still struggling a bit with 2nd period in terms of getting all of the students to perform. He is working closely with the CT to continue to try different strategies to motivate some of his students."

Similarly, an elementary coach described the growth of her candidate and the power of her relationships as,

> "She [the candidate] seems confident in her abilities because of the great experiences that she has had this year. She is anxious about graduation, moving, finding a job and starting her 'real life,' but does not seem anxious about her teaching ability. Her CT has provided her with a wealth of resources and experiences and I'm certain that [the candidate] will feel free to contact her for advice as she begins her first teaching job."

Analysis of Activities of Effective Co-teaching Coaches

The monthly surveys of the effective co-teaching coaches were analyzed to determine the research-based practices that they employed on a regular basis. All of the effective coaches facilitated the candidate's goal-setting during the initial conferences with the candidate and CT, which ultimately resulted in goals that were supported by all three individuals. This is distinctively different from the

coaches who were ranked as Need Development who did not facilitate goal-setting meetings. Rather, the coaches in the Need Development group worked exclusively with the candidate and minimized the role of the CT.

Three of the five effective coaches used the GROW framework (Whitemore, 2002) to support their candidates in establishing personal improvement goals, developing plans to meet their goals,monitoring their progress, and establishing the roles of the CT and coach (see Appendix 2). The other two effective coaches used a structured interview approach. Virtually all of them facilitated conversations where the triad (e.g., CT, candidate and coach) discussed the current reality in the classroom and school, goals for improved candidate performance, and procedures to monitor the candidate's progress in meeting his or her goals, often on improving student learning. Depending on the level, all effective coaches, regardless of their personal tendencies to assume expert or facilitator roles, facilitated goal-writing sessions. Consequently, all candidates established personal improvement goals aimed at high quality teaching of complex content, including structured programs to support emergent literacy, advanced mathematical formulas, and critical thinking about reporting on historical events. To that end, only the high school math coach, who had recently graduated with her Ph.D. in Math Education, used demonstration teaching to model research-based practices in instructing tenth-graders on quadratic formulas.

Two elementary effective coaches and the middle school effective coach were asked by the candidate and CT to benchmark student engagement in their classrooms during whole class instruction. To that end, the coaches used the procedures identified by Sprick, Knight, Reinke, Skyles, and Barnes (2010) to benchmark, describe, and establish goals and monitor improvements on behaviors related toteacher-student interactions, student-to-student interactions, disruptions, engagement, and student responses to instruction. The middle school coach described the success of the procedures with a candidate assigned to a "high energy" 6th grade class:

> "Data collected during the observation of this lesson included two spot checks for engagement using the Academic Engagement monitoring form. During our reflective dialogue, I asked the candidate what percentage of students she thought were actively engaged during my check. Her response was [a figure] lower than what I recorded. During the lesson the Time on Task was 100% at one point and 98% at the end! Although the class was loud in terms of the volume, the students were on task and learning was taking place."

The two elementary coaches reported similar responses to their benchmarking procedures. One CT found it so effective that she shared the practices with her colleagues who did not host a teacher candidate. They, in turn, requested the coach to benchmark the behaviors of the students in their classrooms!

Finally, all five effective coaches described situations in which they conducted basic mentoring of candidates in terms of program requirements for graduation, professional networking, tips for job interviews, and other career-supporting strategies.

Practices of Effective Co-teaching Coaches

It was interesting to note that virtually all of the effective co-teaching coaches describe co-reflection, and ultimately, co-generative dialogue with all of their teacher candidates and CTs. (This was not the case with coaches who scored in the Directive group.) Specifically, our high school coach stated, "During co-planning and co-reflection, Sarah (teacher candidate) and her CT discuss[ed] typical student misconceptions and ways to support their learning…Later during co-instruction, the CT walked around the room helping students, while Sarah taught the lesson." Similarly, one elementary coach reported one session that reflected the candidate's, CT's and coach's co-assessment and co-reflection on the observation data. She observed, "We discussed ways to keep the students involved… Flexibility is essential and he is seeing this."

Implications and Vision for the Future

Vision for the Future

In 2018, the AACTE Clinical Practice Commission provided guidance to teacher education programs throughout the USA. In this report, the commission provided *The Mutual Benefit Proclamation* (p. 38-39) which described the advantages of "properly credentialed professionals who have a mutual respect and appreciation for each other's roles and responsibilities in preparing future educators." AACTE went on to describe the need for mentoring of teacher candidates by CTs and university liaisons (e.g., faculty and/or co-teaching coaches) in non-evaluative ways that focus on coaching, co-teaching, dialogue and reflection. Our vision for the future includes ways to systematically operationalize the recommendations of these national and international organizations, particularly in terms of defining effective coaching practices. In the future, we envision coaching in clinical experiences in preservice education and beyond. To that end, we recommend further investigation of the efficacy of coaching teacher candidates in alternative certification paths and MAT programs, very much like what the Woodrow Wilson Georgia Teacher Fellowship Program has initiated in the USA.

Recommendations for Future Practices

While still in the beginning stages, we feel that the approaches described in this paper and presentation hold promise for future teacher educators and teacher candidates. Our effective coaches demonstrated the capacity to support the development of teacher candidates in implementing research-based, high leverage practices. The goal-setting and monitoring processes (particularly GROW) seemed to provide a vehicle for the candidate, CT, and coach to explore and expand their relationships and to encourage reflective, co-generative dialogue. These practices also provide prospective coaches with various frameworks and data collection procedures which, when used in combination, also offer specific measures for

candidates to use to monitor their own progress as well as the progress of their P-12 students. Thus, based upon these findings, we recommend that university coaches and CTs receive ongoing professional learning on implementing effective communication, facilitation, and pedagogical practices to ensure that coaching be more facilitative, relational, and reflective.

Implementation of GROW beyond pre-service education. As a result of the successful utilization of the GROW document with our pre-service teachers, we have been able to implement it with a select group of our graduates. In 2014, the university described above was awarded funding for a Woodrow Wilson Georgia Teacher Fellowship Program for STEM education. In addition to completely revamping the Masters of Arts in Teaching preparation program, we needed to critically examine our support for our graduates during their induction into teaching.

When individuals enter the fellowship program, each person commits to a three-year induction program with the university. This program is focused on a triad with the fellow, a school-based mentor, and a university mentor. The school-based mentor is typically someone who has had multiple years of experience in the school and is close in discipline to the fellow. The university mentor typically is someone at or associated with the university. The 3rd author of this paper serves as the university mentor for physics candidates even though he is no longer at the institution. He has a background in physics education which is analogous to the other university faculty who have extensive backgrounds in their content area. He has taught classes or has completed research with the fellows, thus forging a personal connection, which is critical.

This triad meets twice in the fall semester and twice in the spring semester. The first meeting consists of a discussion to identify the main goals for the first-year teaching fellow based upon individual strengths and weaknesses, teaching assignments (i.e. AP Physics versus Physical Science), school culture and future goals of the fellow. The fellow then completes a GROW document and gathers evidence for working towards or achieving the goal (typically a video of classroom instruction). These are all uploaded to a secured online repository so that at the second meeting of the semester, everyone in the triad has a chance to view and discuss the work. The first meeting of the spring session thus far has typically resulted in a modification of the GROW document from the previous semester. The teaching fellow then uploads more evidence of working towards the goals in her/his GROW document. In the second meeting during the spring semester, the data is reviewed while discussing the plan for the following year.

We saw major changes in the fellow's goals after the first year, compared to those generated for the second semester in the same year. These modifications were usually attributed to a difference in the types of classes taught, in some cases to a change in school assignments, or to an increase in the fellow's view of where he/she needed to improve. These areas were selected based upon internal reflections or scores on observations from supervisors.

The induction work is generally met with positive reviews from the fellows. They recognize that the extra reflections are beneficial to their growth as a teacher, though the time commitments (especially in the first year) are challenging. The

fellows greatly value the resources and expertise that their mentors offer them. For example, one of the fellows is discussing with the author ways to implement virtual reality (a research area of the third author) into his physics classroom or to possibly work together on a future project.

Limitations of Study

First, university faculty had limited input as to where teacher candidates should be placed, and with whom, while in the field. As a result, the placement in the study could have been random- some teacher candidates were fortunate to work with CTs who actively engaged in collaboration and co-teaching, while others were not. Some teacher candidates engaged in the entire cycle of co-planning, co-instruction, co-assessment, and co-reflection while others were not. This particular limitation, when looking at this work through the lens of self-study, is a factor that is not likely to change and reflects the reality of many teacher education programs in the USA. Our program necessarily faces the disconnect between the faculty, researchers, co-teaching coaches, candidates and the collaborative teachers from various educational settings. One clear outcome of such a disconnect is the inconsistent (or sometimes) broken clinical experiences of our teacher candidates. We believe co-taught clinical experiences have the potential to create the opportunity to increase the communication and collaboration among faculty, researchers, coaches, candidates and teachers.

The second limitation of the study was the participant sample. First of all, the sample was one of convenience. All of the teachers who participated in the study worked in a single district that had negotiated a school-university agreement to host, co-teach, and work with a co-teaching coach during the teacher candidates' yearlong clinical placements. Second, the sample size was which limited the generalizability of the results of the study. This study did not intend to generalize results but to reflect on our findings relative to the operative nature (see the variables of our metric) of co-taught clinical experiences. Future studies that use multiple study sites, with larger sample sizes, could reduce potential bias associated with the findings of this study.

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Appendix 1

Monthly Co-Teaching Coaches' Survey

Coach Name/Content Area/Level: _____
Month: Jan _____ February _____ March _____ April _____

Directions: Identify your teams by name and check the coaching activities conducted this month.

Coach Activities	Team 1	Team 2	Team 3	Team 4
Development of Goal	TC	TC	TC	TC
• Teacher Candidate	Co-T	Co-T	Co-T	Co-T
• Co-teaching Team	SI	SI	SI	SI
• Student Impact				
Advisement on Big Four	Co-T	Co-T	Co-T	Co-T
• Co-teaching Only	DI	DI	DI	DI
• Differentiated Instruction	FA	FA	FA	FA
• Formative Assessment	CM	CM	CM	CM
• Classroom Management				
Benchmark Behavior/Student Engagement	Interact	Interact	Interact	Interact
• Interactions	Disrupt	Disrupt	Disrupt	Disrupt
• Disruptions	Engage	Engage	Engage	Engage
• Engagement	SRespons e	SRespons e	SRespons e	SRespons e
• Student Response				
Advisement on Instructional Practices	CL	CL	CL	CL
• Cooperative Learning	I-B L	I-B L	I-B L	I-B L
• Inquiry-based Learning	Other	Other	Other	Other
• Other_____				
Advisement on Content-related Issues	GPS/CC	GPS/CC	GPS/CC	GPS/CC
• GPS/CC	Other:	Other:	Other:	Other:
• Other_____				
Examination of Student Achievement Data				
Recommendation of Resources				
Facilitation of Co-planning				
Demonstration Teaching				
Basic Mentoring				
Partnership Development				
Other: _____				

Appendix 2

Adapted GROW: A Goal-setting Framework*

Goal**:** The candidate establishes an overarching goal for the final semester of the yearlong clinical that addresses planning, assessment, instruction, impact on student learning, or other. Use the "other" category when the candidate has idiosyncratic concerns that are not necessarily instructional, e.g. relationship issues.

Reality: The supervisor facilitates a discussion of the PLC to determine if the goal is realistic in the current context (or reality). Sample Questions: *Do the students have pre-requisite knowledge?What experiences or courses have you had that have prepared you to conduct this task?* Next the PLC determines the process for measuring, recording, observing or collecting evidence of mastery. *Sample Questions:What types of data should we collect that will be the most useful to you? Who will collect the data?*

Opportunities and alternatives. The PLC creates a plan of how to develop, refine or revise current practices to reach the goal as well as the alternative approaches, strategies, etc. Discuss theoretical considerations relative to the various approaches as well as the research underlying the practice. *Sample DS Questions: What are some strategies or activities you could employ to achieve your desired outcome? Are there specific student who need something extra or different? How can you use co-teaching to help meet those needs? What are the theories that underpin your stated opportunities and alternatives?*

Whodoes **w**hat, **w**hen and **w**hy? The PLC completes a brief plan of action to determine the roles and responsibilities of the supervisor, the CT, and the candidate. *Sample Questions: What do the teacher candidate and collaborating teacher see as an appropriate role for the supervisor? What models of co-teaching do the teachers feel would best support their instruction and students? When (and how) can they co-plan? Specifically, what will the teacher candidate do? Specifically, what will the collaborating teacher do in terms of co-assessment, co-instruction, co-problem-solving.*

Candidate's Growth Statement: The candidate provides a statement of their understanding of how implementing this plan will result in their professional growth, as well as the growth of their students. There is an expectation that the candidate will be able to make general references to underlying theories and/or research. *Sample Questions:What motivated you to create this as a goal? What do you hope to learn from this? What impact will this have upon the learners in your class?*

*Adapted from Whitemore (2002) by T. Strieker, K. Dooley, & M.K. Widener.

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The Effect of Discipline-Related Knowledge on Heritage Language Learners' Reading Comprehension

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This study explores the effect of prior discipline-related knowledge in reading comprehension for two groups of students of Spanish as a Heritage Language (SHL). The first group (G1), had 22 students enrolled in a general Spanish course and the second (G2), had 18 students enrolled in a course of Spanish for medical professions. The aim was to determine whether G2's reading comprehension of a text related to medicine was better than G1's. The instruments used were a lexical recognition test (LR) and a reading comprehension questionnaire (RC), both based on an article related to medicine. The former was used to verify the lexical baseline for both of these groups. From the results of the latter, we conclude that having prior thematic knowledge (in the area of medicine) had no effect on the understanding of this text. Additionally, at lower levels of lexical recognition (between 50% and 70%), the contribution of prior knowledge seemed to be greater, which could indicate that these students would greatly benefit from pre-reading activities that might activate previous knowledge or familiarize them with the topic.

Keywords: Discipline-related knowledge, reading comprehension, Spanish, Heritage language, lexical recognition.

Introduction

In many contexts, reading is arguably the most important of the four communicative skills. Carrell (1988) points out that it is essential in second and foreign language learning settings. It is also essential for learning languages for academic purposes - i.e, for those enrolled in courses where abundant reading material is used in the target language. It is clear that if these students want to be able to compete with native speakers and advance academically and professionally, they need to develop good reading skills.

Grabe (1991) also recognizes that reading is perhaps the most important skill for students of second languages in academic contexts, which has contributed to an increase in the number of studies in this area in recent years. Particularly, given the lingua franca status of English, most studies have been conducted for English as a Second Language (ESL), as a Foreign Language (EFL) and for English for Academic Purposes (EAP), as will be seen later in the discussion of previous

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studies. However, given the current internationalization of markets, an increasingly globalized economy, and migratory flows, other languages are beginning to gain importance on the world stage. This is the case of Spanish, whose presence and importance in the United States are reflected at the governmental level, in the media, business and education (Beaudrie & Fairclough, 2012).

According to the 2010 census, the Hispanic population in the United States surpassed 50 million (constituting 16% of the total population) and it is projected that by the year 2060, it will be around 32% of the total population (US Census Bureau, 2010). Spanish is the second most spoken language in the United States with more than 700,000 students (more than half of the total foreign language enrollment) taking Spanish classes in higher institutions (MLA survey, fall 2016). This greater presence of Spanish explains the growing demand for university courses in Spanish as a foreign language (SFL) and as a heritage language (SHL).

Valdés (2001) identifies a Heritage Language Learner (HLL) as "an individual who is raised in a home where a non-English language is spoken, who speaks or at least understands the language, and who is to some degree bilingual in that language an in English" (p. 38). The author also points out these students are different from the traditional foreign language students in important ways and that this difference has to do with developed functional proficiencies. From this widely accepted definition it is easy to infer that HLLs' linguistic and pedagogical needs are different from those of foreign language students.

Campbell and Rosenthal (2000) state that HLLs come to the classroom with certain superior language skills, which students of foreign language classes could only access after many years of formal study. However, since most of HLLs have not received formal instruction in Spanish, they have had limited access to the prestigious variety of the language and therefore their linguistic uses are characteristic of rural or informal varieties learned at home or in the community.

According to Chevalier (2004), a common characteristic among Heritage Learners across languages is a "lack of familiarity with the full range of stylistic registers available to the educated native speaker" (p. 27). An educated speaker possesses a wide repertoire of formal discourse, including formal speech registers and written genres, to achieve different communication goals. Heritage Learners' linguistic repertoire, on the contrary, is very limited due to their restricted participation in communicative situations, or linguistic domains. They ultimately limit the use of their Heritage Language to the home and family domain characterized by "a casual, conversational speech style, used with familiar interlocutors to a restricted set of topics focused on everyday life" (Chevalier, 2004, p. 28).

Several authors (Chevalier, 2004; Colombi & Harrington, 2012; Colombi & Magaña, 2013) advocate for the development of an advanced 'biliteracy' for HLLs in the university setting that would enable them to alternate between their vernacular variety, the standard variety and academic registers. In this way, they could change their register according to the demands of the social context. Regarding the acquisition of the academic variety of Spanish, Colombi & Magaña (2013) argue that: "The development of academic Spanish increases linguistic repertoires in academic and professional contexts, thereby offering more job and

professional opportunities." (p. 341)

In terms of employment opportunities, there is statistical evidence showing a high demand for bilingual Hispanic professionals in the United States in areas such as business, commerce and medicine, among others. In medicine, the need for translators and interpreters, and bilingual medical assistants or nurses stands out. Therefore, the researchers assert, the demand for courses in Spanish for specific purposes (business, legal, medical, etc.) at the University level is not surprising.

Colombi and Magaña (2013) cite some examples of universities where courses are already offered to address the need for bilingual professionals in the United States. They mention an innovative program recently implemented for Spanish speakers at the University of Texas Pan American (UTPA) that offers a specialization in medical Spanish. Martínez (2010) describes this medical Spanish program as focused mainly on the development of linguistic skills through content related to the medical professions. He states:

Finally, SHL has recently been viewed as a resource for the professions that are progressively becoming more globally competitive. Workforce development in the United States, it is argued, must adjust to the international competition that has been spawned by globalization. (Martínez, 2012, p.70)

Beaudrie (2012) recognizes the progress in recent years in the creation of university programs designed to meet the needs of Spanish speakers in the United States. However, she points out that more qualitative and quantitative research is needed to identify effective pedagogical practices, curricula and programs to ensure that HLLs benefit from high quality instruction.

The experts seem to agree that the most important areas that these students need to develop to achieve access to the prestigious variety of Spanish are reading, writing and vocabulary acquisition (Schwartz, 2003; Valdés, 1997). However, studies in these areas are scarce. For this reason, the objective of this article is to report the results of a preliminary descriptive study with HLLs about the contribution of one of the factors that has traditionally been considered as influential in reading comprehension: previous knowledge of the discipline.

The research question we sought to answer in the present study was: Does previous Medicine-related Knowledge have a positive effect on the comprehension of a text related to medicine for Heritage Language Learners of Spanish? In order to answer it, we compared two groups of HLLs. The first group (G1), had 22 students enrolled in a general Spanish course and the second (G2), had 18 students enrolled in a course of Spanish for medical professions. The aim was to determine whether G2 would score higher than G1 in a reading comprehension test of a medicine-related text.

The following section will delve into some previous studies about SHL reading and some findings about the effect of discipline-related knowledge on ESL, EFL and EAP reading.

Literature Review

Studies on HLL Reading

To begin with, Faltis (1984) studies the relationship between students and instructors' perceptions regarding reading and writing in Spanish and the reading tasks in textbooks and the ones assigned by the instructors. They conclude that although students report a greater practice of informal -non-academic- reading and writing, most of the reading activities (82%) assigned by the language instructors are on academic subjects. The study also concludes that instructors give greater importance to reading than to writing. Besides, although instructors reported to highly value non-academic literacy, assignments in their courses were mostly of academic nature.

In another study, Rodrigo, McQuillan, and Krashen, (1996), conclude that free reading has a positive effect on the acquisition of academic vocabulary for HLLs. Samaniego and Pino (2000) also argue that reading is essential to increase vocabulary and to improve other skills such as writing, grammar knowledge, the development of critical thinking strategies and to expand HLLs knowledge in general. These authors emphasize the importance of explicitly teaching different reading strategies, such as prediction, scanning and skimming, etc. They argue that although students use these strategies while reading in English, it is not clear that they are transferring them to Spanish: "Even when these students have already mastered these skills in English, they need to be made aware that the same skills can be used in Spanish" (pp. 40-41).

Hislope (2003) touches on one of the most studied factors said to affect reading comprehension, prior thematic knowledge. This descriptive study with 10 HLLs aimed to explore their reading habits and skills. The participants read a 4-page article with abundant use of present subjunctive constructions. Then, they answered some questions that measured their recognition of present subjunctive forms. Contrary to the expectations, the excess of subjunctive forms in reading does not positively affect the ability of these readers to recognize it later in the questions. The author concludes that instruction focused on form needs to be more explicit. In addition, given the low performance in terms of reading comprehension found in this group of students, he concludes that it is necessary to activate prior thematic knowledge *before* reading, even with articles about familiar topics. In this regard, he points out:

The reading was simple, and they did not perform well. The topic of the article relates to family values. They all have background knowledge on that topic. If we give our students a completely unfamiliar topic without supporting exercises to activate background knowledge we can only imagine the dire outcome. (p.14)

In another study about SHL reading, Velásquez (2016) investigated the relationship between lexical competence and reading comprehension for HLL college students and the lexical coverage needed to show adequate comprehension of an authentic text. On one hand, she validated the vocabulary knowledge percentage of 98% found for ESL reading by Schmitt, Jiang, & Grabe (2011), but on the other, she found a different type of function to describe the relationship

between lexical coverage and reading comprehension. Her study concluded the curve that best described the relationship between these two variables was not linear (as in Schmitt et al for ESL), but obeyed to the law of diminishing returns, better represented by a logarithmic function. This means, beyond certain lexical coverage range, reading comprehension started to diminish which corroborates Davies (2005) findings for Spanish as a Second language reading.

These few studies found are a clear sign that despite the importance attributed to reading, there is still a gap in the research. Particularly, the effect of prior discipline-related knowledge in SHL reading comprehension is an aspect that needs to be studied and that can shed light on how we can help these students to improve their reading comprehension.

In the following section, we will discuss some results of recent studies on the effect of prior knowledge of the discipline in reading comprehension for ESL, EFL and EAP (fields where most of the research has been conducted). We will then describe our pilot study and discuss the results obtained.

Studies on Discipline-Related Knowledge and Reading Comprehension

In order to improve reading comprehension, specialists have focused on the study of the possible factors that might influence this skill. Some studies are on the influence of the reader's gender and interest (Brantmeier, 2001; 2003; 2006; Bügel & Buunk, 1996); their linguistic ability (Clarke, 1979; Cziko, 1980); Vocabulary knowledge (Hu & Nation, 2000; Laufer, 1989; 1996; Nation, 2006; Schmitt, Jiang, & Grabe, 2011) and other studies consider prior knowledge as an important factor. The latter sometimes allude to cultural knowledge (Schreck, 1981; Pickens, 1982), other times to the thematic knowledge or familiarity with the subject (Recht & Leslie, 1988) or sometimes to prior knowledge of the discipline or specialized academic knowledge (Alderson & Urquhart, 1988; Chen & Donin, 1997; Peretz & Shoham, 1990; Usó-Juan, 2006). It is to this last type of knowledge that we will be referring to in this work.

Empirical studies on the effect of discipline-related knowledge on reading comprehension have yielded contradictory results (Lahuerta, 2009). On one hand, there are those that assign a positive effect to the knowledge of the discipline in reading comprehension (Alderson & Urquhart, 1988; Usó-Juan, 2006) and on the other hand, those that conclude that students do not always demonstrate a better understanding of the texts belonging to their study disciplines (Peretz & Shoham, 1990; Koh, 1984).

Alderson and Urquhart (1988) report the results of two studies that sought to test the hypothesis that the study discipline to which the EFL students belong has an impact on their reading comprehension. The participants in both investigations, from various academic disciplines (administration, engineering, mathematics, physics and human sciences), had a similar linguistic competence according to the scores obtained in a placement test. They answered five reading comprehension tests after reading five passages from different disciplines.

The results indicate that the performance of the students in the comprehension test was much better when the text dealt with subjects related to their own study

disciplines. These authors concluded that: "Below a certain level of text difficulty (of necessity undefined), a certain score could be arrived at by means of (a) linguistic proficiency and (b) general knowledge of the world." (p.181). And also, "Beyond a certain level of linguistic difficulty, more specialized background knowledge would become more important, being used to 'top up' linguistic proficiency scores." (p. 181)

This confirms the hypothesis of the positive effect of prior knowledge in reading comprehension. In addition, the authors conclude that students in specific areas may be at a disadvantage when their reading comprehension is evaluated in subjects that are not part of their study discipline.

One more study on the contribution of prior knowledge and the level of English proficiency in reading comprehension is that of Usó-Juan (2006). The researcher examines whether the low performance in any of these variables (prior knowledge and linguistic ability) can be compensated with a better performance in the other variable, in the case of EAP reading. The participants in this study were 380 native speakers of Spanish enrolled in three different Colleges (Humanities and Social Sciences, Economics and Law and the College of Technology and Experimental Sciences) at the Jaume I University in Castellón, Spain. These students took three types of tests: a reading comprehension test of a text related to their discipline, a general linguistic ability test and a test to measure their previous knowledge of the discipline.

After submitting the results to statistical and multiple regressions analyses, the author concluded that the contribution of the previous knowledge variable accounted for a range of variation between 21% and 31% of the reading of academic texts. The linguistic ability or English proficiency accounted for a range of variation between 58% and 68% of reading for academic purposes. The author concluded that if the student's linguistic competence is advanced or intermediate, they could obtain a satisfactory understanding without having prior knowledge of the subject. On the contrary, students with low levels of linguistic competence would need to reach a certain linguistic threshold and also have prior knowledge to be successful readers.

The results of Peretz and Shoham (1990) are somewhat contrary to those of the two previous studies. That is, they concluded that prior knowledge does not necessarily affect reading comprehension in a positive way. The participants, 177 EFL students in an Israeli university, 80 of Science and Technology and 97 of Humanities and Social Sciences, read two academic texts, one in each of these specialties. The texts were not highly specialized, and were deemed appropriate for first-year university students. They found that the more general the text, the better the students' understanding. Science students performed well in both familiar and non-familiar texts.

Peretz and Shoham also concluded that there is no correlation between the perception of the difficulty of the text and the results of the reading comprehension test. Students intuitively prefer texts related to their discipline of study as they consider them easier to read, but the reading comprehension tests results do not reflect their expectations.

Fernández Toledo (2003) explains the differences between the results

obtained by Alderson and Urquhart (1988) and Peretz and Shoham (1990). He states that:

This may be due to the different degree of specialization of the subjects, which coincides with Zuck and Zuck (1984)'s theory on an effect of the degree of specialization on the type of processing. Apparently, at lower levels of specialization, not only recent knowledge of the subject, but also other general prior knowledge acquired previously, can be intermingled to influence reading comprehension. In another study by Bernhardt (1991), prior knowledge of the subject even negatively affects reading comprehension in the case of some subjects and at different levels. In any situation, it seems that it is difficult to determine the degree of influence of prior thematic knowledge as an isolated element in low levels of thematic specialization. (p.107)

From the studies discussed so far, it is easy to deduce that determining the influence of prior knowledge of the discipline on reading comprehension is not an easy task as there are other variables involved such as the degree of difficulty of the text and the degree of specialization of the readers, among others.

Other type of studies aims to see the interaction between the previous knowledge and the linguistic ability of the reader. They are based on Clarke's *Lexicon Threshold Hypothesis (1979)*, known at the beginning as the *Short Circuit Hypothesis*. According to this theory, students must achieve a certain level of control in their second language (L2) or they must reach a linguistic threshold to be able to transfer reading strategies in their native language to reading in a second language. Readers located below the threshold, or what Clarke called "ceiling" would not be able to transfer their reading skills. A short circuit would occur that would not let them use the proper reading strategies if the reading task in L2 is too complicated.

One of the studies based on this hypothesis is that of Hammadou (1991), who sought to check whether prior thematic knowledge led to a better inferential ability and whether this depended on the level of linguistic ability in the foreign language. He found that there was no direct relationship between prior thematic knowledge and better understanding. Apparently, the most familiar text was the one least remembered by the participants, which leads to the conclusion that thematic familiarity does not have a compensatory effect on low levels of linguistic ability.

Hudson (1982) demonstrates that the activation of prior knowledge as part of pre-reading activities can counteract the deficiency of language skills. The greatest effect is observed with beginner and intermediate level ESL students. This result contradicts that of Koh (1984) according to which readers of L2 understand better the texts of familiar subjects, independently of their linguistic ability.

Lahuerta (2009) points out that, although contradictory results have been found regarding the effects of prior knowledge and the reader's linguistic ability in reading comprehension, recent findings suggest "successful EAP reading comprehension depends on a great extent on the discipline-related knowledge and English-language proficiency." (p.49). This author also discusses some research that indicates the existence of a compensatory effect between these two variables: "There is also a strong compensatory effect between these variables for successful EAP reading and students with low-level English proficiency can successfully

read academic passages if they have reached a linguistic threshold and have discipline-related knowledge." (p.50)

All these studies show the relevance of teaching languages for the professions and offer an insight on how results can help to chart paths for better curriculums, evaluation practices and textbook design for these classes. However, as mentioned earlier, in the case of SHL, the research is almost non-existent and it is a field that needs to be explored especially in view of the recent incursion of Spanish for the professions programs in some universities in the United States. It is necessary for these programs to take advantage of the linguistic resources offered by their HLLs.

Methodology

To explore the effect of prior knowledge of the discipline on SHL reading comprehension, a descriptive study was conducted with two groups of HLLs that were classified as intermediate level at two different Higher Education institutions in Texas. One of the groups was studying general Spanish in a traditional course specifically designed for HLLs, without any emphasis on any particular discipline. The other was a group of students of Spanish for the medical professions. The aim was to compare the reading comprehension performance of these two groups after taking a reading comprehension test of a text related to medicine.

The research question we sought to answer in the present study was: Does previous Medicine-related Knowledge have a positive effect on the comprehension of a text related to medicine for Heritage Language Learners of Spanish?

Detailed information on the participants and the instruments used will be offered in the next sections.

Participants

The first of the two groups participating in this study (G1) had 22 students enrolled in an intermediate course for HLLs at a Metropolitan University in Texas. All students at this institution are expected to complete 6 credit hours at the intermediate level to fulfill the foreign language requirement. There are two language-learning programs: Second Language and Heritage Language. The Second Language Program is designed for students who learned Spanish formally while in school and those students with no previous Spanish language knowledge or background. The Heritage Language Program is for students who grew up in an environment where Spanish was spoken. They may be fluent in Spanish or just understand it. Both programs offer several undergraduate level courses in Elementary, Intermediate and Advanced Spanish, designed to develop all four language skills: listening, speaking, reading and writing, as well as culture. Placement in the correct course is based on specific placement exams. The course sequence (at the time of the present study) in the SHL program was as follows:

First-year Spanish for HL (one course): Intensive Elementary Spanish
Second-year Spanish for HL (two courses): Spanish for HL 1 and Spanish for

HL 2.

G1 participants were enrolled in a Spanish for HL 1 course and they were majoring in Communication, Journalism, Engineering, Psychology, Anthropology and Political Science.

The second group of participants (G2) consisted of 18 HLLs enrolled in a Medical Spanish course at another Texan Higher Education Institution. This is the first of four intermediate and advanced courses that constitute the Medical Spanish for Heritage Learners (MSHL) academic minor. As in the case of G1, students in this group were also at the intermediate level. However, unlike G1, these students were all majoring in areas related to medicine and health sciences, such as nursing, occupational therapy, pharmacy, medical care, rehabilitation and clinical laboratory.

The courses in this program focus on the context-based development of targeted language skills for healthcare professionals and on gaining critical awareness of the effects of multilingualism on population health (Martinez, 2010). They are designed to develop three linguistic competences: advanced medical terminology in Spanish, medical interpreting and translation skills, and basic understanding of the public health disciplines. The program combines advanced language and cultural study with multiple service opportunities in the local community and at the national level.

Instruments

The reading passage utilized for this study was published in a Colombian newspaper and was obtained digitally. The article, entitled: *¿En qué área de la medicina conviene invertir*? (Which area of medicine should we invest in?) is an authentic text, written for a broad audience, with some vocabulary related to the medical profession but not very specialized so that an average reader would be able to understand its content.

Participants in each of these groups took two tests, one for lexical recognition (LR) and another for reading comprehension (RC). The latter was a multiple-choice test based on the content of the article they read. No direct questions about vocabulary were included in this test, and all of there were inference type questions. As for the lexical recognition test, its objective was, on one hand, to measure the amount of vocabulary from the passage that each student was able to recognize, and on the other to verify the homogeneity of both groups in terms of their general linguistic competence in Spanish. Numerous studies, some of which are discussed below, establish a high correlation between the students' lexical competence and other linguistic abilities, so it was considered pertinent to measure the students' vocabulary recognition and use this measurement as an indicator of their linguistic ability.

Read (2007), for example, points out the validity of LR tests to measure the amount of lexicon of the students and their linguistic competence. Today, several universities use this kind of tests, mostly along with other additional measures, to place students in different courses by levels or to diagnose their language skills. Fairclough (2011) in a study with speakers of Spanish as a Heritage Language

concludes that these types of tests are valid instruments to measure the linguistic abilities of this population and proposes its use as placement instrument in the language programs designed for these students.

The lexical recognition test designed for this study contains vocabulary from the reading passage. It consists of 150 lexical items, 100 of which are words taken from the text and 50 are invented words that are not part of the Spanish lexical repertoire, but follow the same morpho-phonological patterns. Some examples of these words are: *hombril, *calorir and *confusing. The students had to mark the words that they recognized as belonging to the Spanish language and to leave unmarked those that did not.

The inclusion of invented words is a control mechanism used in this type of test to discard those students who tend to overvalue their lexical recognition in a language.

The 100 words used in the LR test were chosen from the dictionary of the 5000 most frequent Spanish words by Davies (2006) -A frequency dictionary of Spanish: Core vocabulary for learners. In this dictionary, each word is assigned a number according to its frequency of use and five levels are established. The first level for the thousand most frequent words (with frequencies from 1 to 1000), the second for the following words (with frequencies 1,001 to 2,000), the third for words with frequencies from 2001 to 3,000 and so on up to level 5.

We assumed that the students knew the first level words (articles, pronouns and in general words of low semantic content), so their inclusion was ruled out. We used all words found in the second to the fifth level (69 words in total) and then added 25 words that did not appear in the dictionary because of their low frequency of use. A total of 94 words were obtained. To complete the 100 words we added 6 randomly chosen words from the first level. In this way, a representative sample of the vocabulary of the text was obtained.

Procedure

Students answered both tests during normal class sessions, with their respective instructors. It took them an average of 40 minutes to answer both the LR test and the RC. The results were collected and scored to start the analysis. The tests were scored using a scale of 0 to 100, according to the following formula: [(number of correct answers)/(number of questions)] x 100. Then the data was tabulated and we proceeded to analyze the findings.

Results

Table 1 shows the results of both tests for each group. The average lexical recognition of G1 (N = 22) was 85% (SD = 7.9), very similar to that of G2 (N = 18), which was 84% (SD = 10.2). The result of a t test for independent samples, $t(38) = 0.12$, ($p = 0.89$), led us to conclude that there was no statistically significant difference between the lexical recognition of these two groups. Because both groups' lexical coverage was homogeneous, we can then infer the comparability of their linguistic skills.

Table 1. Results of the RC and LR tests for groups G1 and G2

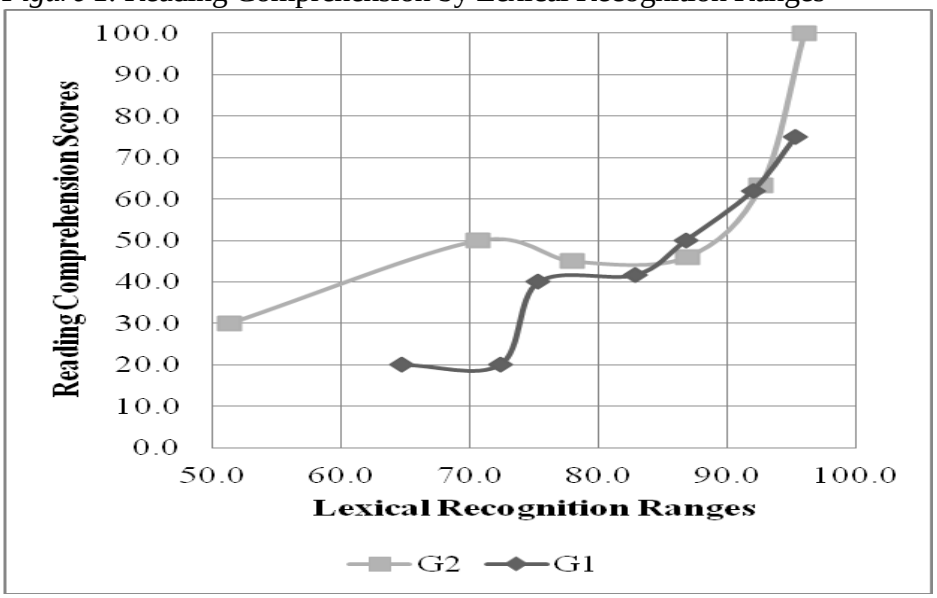
	Group	N	Average (%)	Standard Deviation
RC	G1	22	48	23.0
	G2	18	51	22.7
LR	G1	22	85	7.9
	G2	18	84	10.2

As for the RC test, the average for G1 (N = 22) was 48%, (SD = 23.0), while for G2 (N = 18) it was somewhat higher, 51%, (SD = 22.7). The result of a t test, t (38) = -0.40, (p = 0.68) revealed that there was no statistically significant difference between the scores obtained in the reading comprehension test of this text related to medicine for these two groups of HLLs.

This would lead us to conclude that the thematic prior knowledge (in the area of medicine) of the G2 group had no effect on the understanding of a text related to this discipline. The G2 group did not demonstrate a significantly higher performance in the reading comprehension test and its comprehension was similar to that of the G1 group without (apparent) knowledge of the discipline.

However, with the help of Figure 1, we can better visualize and analyze the interaction of the variables involved in this study and compare both groups' reading comprehension at different levels of linguistic competence. This figure is the result of grouping LR scores in different ranges (50-55, 55-60, 60-65 and so on) and then averaging the corresponding RC at those intervals.

Figure 1. Reading Comprehension by Lexical Recognition Ranges



Discussion

From Figure 1, it is evident that even though the lowest rank of LR was obtained by G2, the reading comprehension of this group was superior in most of the ranges. Between 75% and 85% approximately, very similar percentages of

comprehension were observed for the two groups, but even so, RC was greater for G2. Between 87% and 95%, G2's RC is slightly below that of G1, but then in the interval of 95% to 100%, G2's scores once again surpassed G1's. It should be noted that although G2 obtained the minimum LR score (51%), it also obtained the maximum RC score (100%).

At the lowest levels of lexical recognition (between 50% and 70% approximately) is where the greatest difference in reading comprehension could be seen (G2 scores were higher than those of G1). It might be that students within that lexical coverage range would benefit more from having prior knowledge of the discipline. Those at higher LR ranges could be using other resources or strategies; therefore other factors would contribute more significantly in their reading comprehension.

In other words, it is at low ranges of lexical recognition (50% - 70%), where discipline- related knowledge seemed to have an impact on students' reading comprehension. Having previous knowledge of the discipline made a difference and, in a way, seemed to have a compensatory effect for those students with a limited lexical and linguistic competence. Perhaps, at these low LR levels the activation of previous knowledge and explicit vocabulary instruction, as part of the pre-reading activities would greatly help them to improve their reading comprehension.

At first sight our results seem to corroborate some previous studies for ESL (Peretz & Shoham's, 1990; Koh, 1984), according to which prior discipline-related knowledge does not necessarily affect reading comprehension in a positive way. In our case, having prior medicine-related knowledge did not have a positive contribution in HLLs' comprehension of a medical text. This could have been due to the low level of linguistic competence of both groups that is reflected in their low LR percentages [LR(G1) = 85% and LR(G2) = 84%].

Velásquez (2016) concluded HLLs need around 98% of vocabulary coverage to show adequate comprehension of an authentic Spanish reading passage, which would also help us explain the low RC scores obtained by G1 and G2 (48% and 51%, respectively). It is evident this reading passage was very challenging for the participants of this study which underscores the importance of choosing appropriate reading materials for this classes.

In conclusion, none of the groups seemed to have reached the linguistic threshold suggested by some scholars (Usó-Juan, 2006; Lahuerta, 2009) and by studies based on Clarke's Lexicon Hypothesis that, in addition to prior knowledge of the discipline, would have made a significant contribution towards an improved reading comprehension.

With such a small sample it is very difficult and risky to draw conclusions regarding the existence of a possible lexical threshold (as suggested in previous studies for EAP, EFL and ESL) that once reached would trigger a stronger effect of discipline-related knowledge on reading comprehension. Nor it is possible from this study alone to draw a conclusion about possible compensatory effects between lexical competence and prior knowledge. For this purpose, it would be necessary to increase the number of participants and possibly refine the instruments for measuring reading comprehension and also prior knowledge.

Further studies should consider the implementation of additional instruments that allow the measurement of prior knowledge, such as surveys, tests or interviews. Similarly, other complementary reading comprehension instruments, such as 'Cloze' tests or summaries should be used in the future to ensure a more accurate measurement of reading comprehension. Moreover, other studies can be conducted incorporating additional variables that definitely play an important role and that were not considered in this study such as text and test difficulty and the degree of specialization of the students.

Another important factor that should not be ignored is the reader's interest in the topic, which may in some way influence his comprehension. The presence of this and all other variables previously mentioned makes the design of studies like this a very challenging task. However, we hope this can be considered a good starting point in the exploration of the effect of prior knowledge of the discipline in HLL's reading comprehension.

Conclusions

The present study aimed to compare the reading comprehension performance of two groups of HLLs of Spanish to determine if having prior medicine-related knowledge could have a positive impact reflected in higher scores in a reading comprehension test. Since the difference found in the RC average scores obtained by both groups was not statistically significant, we can conclude that for these two groups, prior knowledge of the discipline did not have a positive effect on the reading comprehension of an authentic newspaper article related to medicine.

One possible explanation we offered is that overall scores were consistent with a low linguistic competence level. Both groups scored very low in the LR test, an indicator of not having enough vocabulary to show adequate comprehension of the reading passage utilized. As previously suggested for ESL and SHL reading, students might need to reach certain linguistic/lexical threshold to be able to take advantage of any prior discipline-related knowledge and this was not the case.

However, a detailed analysis of the reading comprehension figure revealed the medical Spanish group (G2) scored higher in reading comprehension in most of the lexical recognition ranges. This group of students also obtained the minimum LR score (51) and the maximum of RC (100). In the LR ranges below 70% the difference between the two groups is greater (G2 has better comprehension scores than G1), which seems to suggest that in these ranges prior knowledge's contribution towards reading comprehension is greater.

One of the implications of this finding is that at low LR levels, the activation of previous knowledge and explicit vocabulary instruction, as part of the pre-reading activities, would greatly help HLLs improve their reading comprehension. We also emphasize the importance of considering other factors that were disregarded in this study and that might have played a major role: text and test difficulty and reader's motivation. In addition, for future studies we suggest the design and implementation of other instruments to measure RC, previous

knowledge and LR, such as surveys, translations, summaries, interviews, etc.

Extensive academic reading is important for HLLs because it gives them access to the standard variety of the language, by increasing their lexical repertoire. It also provides models that can help them improve their writing skills. Without a strong reading and writing ability, heritage speakers are denied access to the formal register and therefore to many job and academic opportunities, as they cannot compete with native speakers. That is why HLL's instructors should implement effective strategies for explicitly teaching reading through the exploration of the different factors that positively affect this skill.

Studies like this can make an impact on the teaching of Spanish for the professions; a field that is growing and is already showing promising results, especially for Spanish as a heritage language in the United States. Thanks to the needs imposed by the globalization of the labor market, certain minority languages (particularly Spanish), are starting to be considered as potential resources that contribute to the insertion and greater competitiveness in the scenario of the globalized professional market. Today more than ever, researchers and educational administrators are obliged to take advantage of the momentum that these new initiatives are taking to promote more empirical studies that inform pedagogical and evaluation practices thus contributing to validate the importance of these programs.

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Translanguaging Practices of Multilingual Learners of German

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This qualitative case study draws on a theoretical framework of translanguaging (García & Wei, 2014) and border pedagogies (Cashman, 2015) and seeks to shed light on the question of what role translanguaging can play in students' language learning in a German as a foreign language class at a Hispanic-serving university that is situated in the United States-Mexico borderland. This case study focuses on 18 students who were part of a larger participatory action research study (Lichtman, 2013), which includes focus groups, individual interviews, as well as audio-recordings of classroom discussions that were transcribed and analyzed using thematic analysis. The data highlights translanguaging as a language learning practice that also contributes to reflections on identity formation and language choice in an educational climate that is often hostile towards immigrant cultures and languages.

Keywords: bilingual, German language, instruction, translanguaging.

Introduction

The number of bilingual students in the United States is continuously rising. From currently 37 million speakers it is projected to grow to 40 million by 2020 (Lopez, 2013). Moreover, the U.S. Department of Education National Center for Education Statistics (2015) states that the number of English language learners has been increasing, and 15.5% of the public-school students in Texas were English language learners during the 2014/2015 school year. Yet a review of secondary level curricula for German as a foreign language produced by American textbook companies illustrates that textbooks and teaching materials for German are written assuming students to be monolingual English speakers (U.S. Department of Education, 2015). Textbook publishers that focus on an American audience and produce German curriculum for college level German classes include McGraw-Hill and Pearson. All German textbooks available from these publishers use a communicative approach to teaching German as a first foreign language (Gonglewski, 2013; Di Donato, 2004; Tschirner, 2017). Bilingual students bring untapped potential to the classroom, which is not recognized by textbooks or considered in research on German learning in the United States.

The study takes place at a borderland university, with a student body of about 80% Hispanics (UTEP, 2017) in a town that has made the news for a testing scandal in which bilingual and immigrant children were prohibited to participate in

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high-stakes state testing or were pushed out of the educational system altogether; being bilingual was framed as a problem (Reyes, 2016). Overall in the German as a foreign language class the bilingual or multilingual students do not see themselves represented because the curriculum and the textbooks seem to assume that only monolingual English-speakers learn German, which overlooks the linguistic repertoire of multilingual students. It leads to the question of who is represented (monolingual English speakers) and who is absent from both research and the curriculum (low-income bilingual students). The context of this study is an environment with very dominant discourses that frame bilinguals as having language deficits (Reyes, 2016). Moreover, assimilationist discourses, essentializing discourses and normalizing discourses of whiteness (Abraham, 2014) are being internalized by students and become authoritative discourses that guide students' behavior and language choices. Translanguaging is originally a pedagogical practice from bilingual schools in Wales and originated from the Welsh word for *trawsieithu* referring to having "input in one language and conducting a task in another language" (Cenoz & Gorter, 2011, p. 341). Translanguaging as an approach considers the different languages that a bilingual or multilingual person speaks as one linguistic repertoire (García & Wei, 2014) and views a bilingual person as more than just a combination of two monolinguals (Grosjean, 2010). García explains translanguaging as "multiple discursive practices in which bilinguals engage in order to make sense of their bilingual worlds," which is the norm in bilingual communities (García & Wei, 2014, p. 22). García & Sylvan (2011) also theorize translanguaging as "a product of border thinking, of knowledge that is autochthonous and conceived from a bilingual, not monolingual, position" (p. 389). Creese and Blackledge (2010) argue for translanguaging as bilingual pedagogy and state that translanguaging (García, 2007) and heteroglossia (Bakhtin, 1981) serve "to describe language fluidity and movement" (Creese & Blackledge, 2010, p.112). Translanguaging can be perceived as a heteroglossic practice and pedagogy for social justice (García & Leiva, 2014, p. 204). When using translanguaging practices in the classroom, students' epistemological frameworks might change along with what they believe to be true about a language.

This study tries to facilitate a learning process in which students gain a higher level of consciousness (Freire, 1970) about languages which contributes to positive multilingual identity development. The research focuses on the role of translanguaging in the German language classroom.

Literature Review

Current research on German learning in the United States focuses on monolingual students (Bartolotti & Marian, 2017; Belz & Reinhardt, 2004; Scheutz & Eberhard, 2004; Schmid, 2014; Abrams, 2016; de Oliveira Santos, 2015; Neville, Shelton, & McInnis, 2009; Dixon & Hondo, 2013). Bilingual identity is only explored in a few research studies that focus on German instructors-the biliteracy of students is not considered (Aslan, 2015; Ghanem,

2015; Weninger, 2007). The current approach of focusing on monolingual learners of German leads to the problem that bilingual student populations are underrepresented in the available research in the United States. As Grenfell and Harris (2015) point out there is research in the field of third language acquisition, but little research on German as a third language particularly outside of Europe (Grenfell & Harris, 2015). While it has been established that a second language influences the learning process of a third language as much as a first language, and that there is a growing number of bilingual students in the United States, German as a third language has not been studied widely (Falk & Bardel, 2010). Although research on third language learning is available in the United States it does not focus on German (Bono & Stratilaki, 2009; Cenoz & Gorter, 2011; De Angelis, 2007; De Angelis, 2011; Jaensch, 2011; Jessner, 2008; Rothman, Iverson, & Jurdy, 2010), but mostly on cognitive language learning (Bartolotti & Marian, 2017; Scheutz & Eberhard, 2004; Schmid, 2014), isolated language learning strategies (Abrams, 2016; de Oliveira Santos, 2015; Neville, Shelton, & McInnis, 2009; Dixon & Hondo, 2014) or German instructors (Aslan, 2015; Ghanem, 2015; Weninger, 2007). Cross-cultural differences have also been studied. For example one study focuses on cross-cultural differences between Spanish and German bilinguals who when tested in Spanish scored higher on extraversion and neuroticism while they scored high on agreeability when tested in German (Veltkamp, Recio, Jacobs, & Conrad, 2012). It can be observed that those studies that focus on German language learning in the United States only have monolingual English-speaking students as participants who are learning German (Dixon & Hondo, 2013; Jackson, 2007; Neville, Shelton, & McInnis, 2009). The available research on multilingualism points out that the students' languages are only useful resources for learning a new language if they are allowed in the classroom and if they are part of how the teacher teaches the new language. Furthermore, a teacher must be able to facilitate the relationships between previous languages and a new language (Jessner, 2008; Grenfell & Harris, 2015).

The use of English is associated with being at the core of what constitutes being an American according to the dominant discourse, which can be described as the one nation, one language ideology (Hansen-Thomas, 2007; Hornberger, 2002). Students who might happen to speak other home languages will try to subscribe to this dominant discourse and adopt English language practices for their communicative purposes while in the university setting, because they tend to be aware of the cultural capital of English versus their home dialects or home languages (Ullman, 2012). Language ideologies are very powerful (Schieffelin, Woolard, & Kroskrity, 1998; Woolard, 1992). They are defined as the "beliefs, ideas amd values that exist as systems binding communities together" (Razfar & Rumenapp, 2012, p. 348). The beliefs about languages become revealed as well as reproduced through cultural practices (Razfar & Rumenapp, 2012). Language ideologies are representing "ideas of power and identity as constructed by a society" (Razfar & Rumenapp, 2012, p. 349). Language hegemony and the domination of ideologies are backed up by policies and politics, this hegemony can be observed in classrooms as well, because "power structures are inherent in every instance of language use" (Razfar & Rumenapp, 2012, p. 349). Classroom

discourse is mediating interactions. "Making language ideologies explicit opens the classroom as a site where teachers and students can contest hegemonic symbolic relations and inequitable power structures, and seek transformative change" (Razfar & Rumenapp, 2012, p. 365). According to Schieffelin, Woolard, & Kroskrity (1998) language ideologies underpin notions of identity. Language ideologies and identities are closely connected, which is demonstrated for example in a study by Turkan and DaSilva Iddings (2012) who look at English language learners' identities in an era of standardized testing, in which hegemonic ideologies about English guide educational policies (Turkan & DaSilva Iddings, 2012). Speaking English and being successful in educational settings are discourses that are related to educational policy. The methaphor of speaking English as a success impacts immigrant children's self-identification and conceptions of language according to Turkan & DaSilva Iddings (2012). Deficit notions for so called non-native language speakers are widespread in educational settings, because emergent bilinguals or multilingual students are measured against monolingual speakers (Cenoz & Gorter, 2011). Grosjean (2010) has been arguing that the communicative competence of a bilingual person cannot be compared to that of a monolingual. Bilinguals are valued for their multicompetences within a dynamic bilingualism conceptualization (García & Sylvan, 2011, p.389). García & Sylvan (2011) also theorize translanguaging as "a product of border thinking, of knowledge that is autochthonous and conceived from a bilingual, not monolingual, position" (García & Sylvan, 2011, p.389).

While Anzaldúa (1987) differentiates the various languages she speaks in *Borderlands/La Frontera* as standard English, standard Mexican Spanish, standard Spanish, working class English, North Mexican Spanish dialect, Chicano Spanish with regional variations in Texas, New Mexico, Arizona, and California, Tex-Mex and Pachuco, translanguaging is moving away from the concept of different distinct language systems that exist inside the multilingual person's mind but it maps those as part of one fluid language repertoire. Translanguaging is the lived practice of students around the border (Cervantes-Soon & Carillo, 2016; Collins & Cioe-Pena, 2016; Creese & Blackledge, 2010; Esquinca, Araujo, & de la Piedra, 2014; García, Homonoff Woodley, Flores, & Chu, 2012; Lewis, Jones, & Baker, 2012; Mazak & Herbas-Donoso, 2015; Melo-Pfeifer, 2015; Ramirez, Ross, & Jimenez-Silva, 2016; Rios, 2013; Salinas, Vuckery, & Franquiz, 2016; Velasco & García, 2014). Speakers effortlessly include both elements of their Spanish and English language repertoire into a conversation, students who are learning an additional language such as German in the case of this study will include German into their available register and make use of Spanish, English and German depending also on the communicative needs of their interlocutor. Translanguaging together with border pedagogy and heteroglossia inform a pedagogical approach for teaching German through which students might be able to deconstruct their language ideologies and the dominant monolingual discourses through a raised consciousness and reflexive practices. Multiple studies in recent years have adopted border pedagogies or the concept of borderland (Cervantes-Soon & Carrillo, 2016; Cashman, 2015, 2016; Ramirez, Ross, & Jimenez-Silva, 2016; Reyes, 2016; Rios, 2013; Stewart & Gachago, 2016). Rios' (2013) study on

Chicana students in the borderland applied border pedagogies and specifically critical dialogue, which lead to a deconstruction of race and culture in the classroom. Wilson, Ek, Ty, and Douglas (2014) used border crossing pedagogies in order to highlight that Latina/o students were made invisible in their secondary school. In a similar manner, Reyes (2016) gives the case of the El Paso Independent School District corruption scandal as an example for the silencing of Latina/o student voices, who were systematically excluded from high stakes testing or pushed out of the high school system altogether in order to improve the state exam test scores for the district. As Reyes (2016) summarizes the EPISD test cheating scandal in El Paso reflects the complexities of the border identity and education of marginalized Mexican-American students. Moreover, the borderland is rich in discourses and tensions between "nationalism, bilingualism, monolingualism, racism, discrimination, and uniformity" (Reyes, 2016, p. 347). Humanizing aspects of border pedagogies are also demonstrated by Stewart & Gachago (2016) in a transcontinental border crossing digital storytelling project which results show that through the project notions of otherness were critically demystified, which allows students to counter global hegemonic discourses. In current research activism is also seen as an essential part of border pedagogy (Ramirez, Ross, & Jimenez-Silva, 2016). In their qualitative study on two U.S. Latina teachers in a border community in California Ramirez, Ross and Jimenez-Silva (2016) found that the teachers applied border pedagogy through authentic care/cariño (Valenzuela, 1999), critical consciousness/ concientizacíon (Freire, 1970), and community activism (Ramirez, Ross, & Jimenez-Silva, 2016, p. 318). Ramirez, Ross and Jimenez-Silva (2016) in their theoretical framework for their study draw on nepantla (Anzaldúa, 1987) as a place where the transformation of identities can take place. Through the enactment of border pedagogy students developed critical consciousness together with their teachers in this nepantla space (Ramirez, Ross, & Jimenez-Silva, 2016, p. 304). In a similar qualitative case study with one focal teacher education candidate observing one high school student labeled as having limited English language skills, LatCrit was used in order to deconstruct majoritarian tales of what it means to be a citizen in the United States (Salinas, Vuckery, & Franquiz, 2016). The findings indicate that the student teacher's prior assumptions could be transformed, and Latina/o students could challenge dominant discourses by using mestiza consciousness (Anzaldúa, 1987). In an ethnographic study that took place in the academic year of 2009 and 2010 at Preparatoria Altavista in Juárez, Mexico, Cervantes-Soon observed 10 female students in and outside the classroom, interviewed students and teachers. This ethnographic work together with a theoretical framework building on border thinking Mestiz@ theories of intelligence (Carrillo, 2013), and Chicana feminist thought (Anzaldúa, 1987) informed three decolonizing border pedagogy practices for border thinking that Cervantes-Soon and Carrillo (2016) propose: straddling, translanguaging and testimonio (p.288). Cervantes-Soon and Carrillo (2016) connected cultural capital, border pedagogy and translanguaging. They explain that while students need to be aware of the cultural capital of the dominant world, they propose translanguaging, which they see closely related to border crossing and as an essential part of border pedagogy as a way to overcome an Anglophone

monolingualism, and a deficit view of bilingualism, and at the same time overcome a negative view of border variances of Spanish (Cervantes-Soon & Carrillo, 2016; Zentella, 2007).Translanguaging, through their dialogic border pedagogy praxis orientation (Cashman, 2016) is described as a heteroglossic practice for social justice. This notion is in sync with García's theorizing of translanguaging as a heteroglossic practice and pedagogy for social justice.

Methodology

A qualitative case study seems appropriate to shed light on the question of how multilingual students make sense of learning German through their language choices at a borderland university. As a language educator, I create translanguaging spaces and use authentic care/*cariño* (Valenzuela, 1999), critical consciousness/ *concientizacíon* (Freire, 1970), and community activism (Ramirez, Ross, & Jimenez-Silva, 2016, p. 318) in my classroom. The borderland community in El Paso is a widely bilingual one. Where you can never make assumptions about who speaks Spanish and who does not. Speaking English is clearly connected with "Americanness" and whiteness. The examples from the classroom show that students who self-identify as bilingual in Spanish and English and as Mexican prefer to speak in either or language and have negative sentiments towards mixing both.

I value and embrace students' histories and linguistic resources and see myself as a facilitator of learning in the classroom (García, Homonoff Woodley, Flores & Chu, 2012). García, Ibarra Johnson and Seltzer (2017) highlight that a translanguaging classroom is strategic and purposeful in setting up a "powerful, equitable learning environment" (p.16) which enables students "to (1) engage with complex content and texts, (2) strengthen linguistic practices for academic contexts, (3) draw on their bilingualism and ways of knowing, and (4) develop socioemotionally with strong bilingual identities" (p.16). If teachers manage to set up their classroom effectively according to these guidelines, they can advance social justice (García & Ibarra Johnson & Seltzer, 2017, p. 16).

This study will add to the theory about translanguaging, which so far is centered mostly on Spanish and English in the United States (Esquinca, 2013; Esquinca, Araujo, & de la Piedra, 2014; García, 2014; García, 2009; García & Sylvan, 2011; García & Wei, 2014; García, Homonoff Woodley, Flores, & Chu, 2012; Sembiante, 2016). The primary data for this study includes audio-recordings of every German class-session in the 2018 spring semester at a borderland university in the Southwest of the United States. Furthermore, the 19 participants of this case study took part in a series of three phenomenological interviews (Seidman, 2013). Three different sections of German are part of this study at two different language levels, German one and German two. German one is a class for beginners. Some of the participants in the German one class had some prior knowledge of German either through previous classes taken in high school or through family members, the majority had no prior knowledge of German. The German two classes are geared towards advanced beginners who have prior

knowledge of grammatical structures and have the comprehension skills and vocabulary skills to hold a short conversation about a familiar topic in German. The German one course has 21 participants while the two German two courses have 11 and 12 participants respectively.

Participants of the Study

The 44 participants of the main study in the three sections of German used different language combinations: English-German and Spanish-German, some participants used all three languages for their interactions in class depending on the communicative need of the interlocutor. All participants completed the series of three phenomenological interviews. During the second interview all 44 participants were asked how they self-identify and the following categories emerged: 16 said they identify as American and 14 identified as Mexican. 11of the students identified as Mexican-Americans or Hispanic or Latina/o and three identified as Chicana/o. For this case study I focused on representative cases from each of the groups, yielding a total of 19 participants (18 students and myself as the instructor) who are included in this case study. Those participants who identified as Mexican also tended to self-identify as bilingual in English and Spanish, while those who identified as American tended to describe themselves as not bilingual, even though they had familiarity with another language other than English. Of the 16 participants that fall under this category, five either had German heritage or one German parent or were born in Germany and had lived there for a period of time. Some of the participants spoke Spanish at home with family members but did not consider themselves as bilinguals because of their perceived deficits in academic or standard Spanish. All participants chose their own pseudonym for the study.

Data Analysis

During the spring semester 2018 every German class was audio-recorded and all interactions were transcribed. From all the transcriptions available I chose seven that give examples of typical group work or conversations. The excerpts are selected from all three classes that participated and represent 19 participants. Those participants give perspectives on the different student groups that were represented in the three German classes (Creswell, 2005). Furthermore, all case study participants had completed three phenomenological interviews, in order to gain insight into the students' heritage and language use growing up as well as their language choices in prior educational settings before entering the German class. The series of interviews also served the purpose to member check with participants because they had a chance to see their transcribed interactions from the classes and to provide their feedback on it, which allowed to triangulate the data. All data was analyzed with thematic analysis for emerging themes.

Findings/Results

The seven excerpts in this section show examples of classroom interactions of the different participant groups. Excerpts one and two show that multilingual interactions are taking place in the German class. Students identifying as Mexican often used Spanish to discuss content and ask each other questions about the tasks at hand, as excerpts one and two show. The students in both groups self-identified as Mexican and bilingual in Spanish and English. In line 21 and line 23 of excerpt one Claudia addresses me in English to verify her answer, and in line 42 she uses English to answer a question that I had asked the whole class.

During this interaction, the students were working on an activity in the *Treffpunkt Deutsch* textbook during the German 2 class. The activity focuses on verbs with stem-vowel change, and students have to work together to complete sentences that are projected to the front of the classroom. They are expected to use correctly conjugated verb forms in the sentences. The English translation of German and Spanish is added in the middle column of the table. On the left side of the table is the actual conversation between the two students Claudia and Humberto and me, the teacher. I am walking around the room listening to different groups during this activity. This excerpt is an example of a typical conversation in class. The task that students were working on was two-fold, they first had to find the third person singular conjugation of a verb with stem vowel change and then transform the sentence into the plural form, which required a third person plural conjugation.

A=Annabell (instructor)
C=Claudia
H=Humberto
Spanish is <u>underlined</u> in the original utterance and the English translation

Table 1. Excerpt 1 In-class Conversation

Utterance	**English Translation**	**Explanation**
1 C: fährt	*drives*	Claudia is reassuring herself that her answer is correct by getting the teachers attention while conjugating out loud
2 A: Oma Ziegler is third person singular, ich fahre, du fährst, er fährt	*Grandma Ziegler ... I drive, you drive, he drives*	The teacher gives an explanation and reassures Claudia that her answer is correct
3 C: Ich fahre, fährst du einen fahren Sie	*I drive, drive you a drive you (formal)*	Claudia conjugates the stem-changing verb *fahren*
4 H: Entschuldigung, wo (Pause 5 seconds) okay Entschuldigung wo halts hier der Bus?	*Excuse me, where okay excuse me where does the bus stop here?*	Humberto is working on the sentence that this group is looking at and he is using the correct word order in German; however, he forgot the a-*Umlaut* on halt
5 C: <u>No creo que</u> er, <u>no? Porque esta hablando de una cosa</u> er, sie, es	*<u>I don't think it is</u> he? <u>Because you were talking about a thing</u> he, she, it*	Claudia is questioning the third person singular conjugation Humberto chose

6 H: Creo	*I belive so*	Humberto insists
7 C: er hält porque recuerdate que suena como ä	*he stops because remember that it sounds like ä*	Claudia tells Humberto the correct conjugation for this sentence with the stem vowel change
8 H: Entschuldigung wo hält hier die Busse	*Excuse me where does the busses stops here [incorrect combination of singular verb conjugation with a plural noun]*	Now Humberto includes this information into his sentence that he transformed into plural; however, his conjugation of 'to stop' is not correct, because the a-*Umlaut* should not be used in the plural
9 C: como a	*like a [pronounced like a Spanish/German a]*	Claudia caught the mistake and tells him that it should be with an "a", the vowel sound "a" is identical between Spanish and German so she is telling him in Spanish what the correct vowel sound would have been
10 H: Entschuldigung wo halt hier der Bus die Busse, Entschuldigung wo halt hier die Busse. Enschuldigung wo halten hier die Busse	*Excuse me where does the bus the busses stop here, Excuse me where do the busses stop here. Excuse me where stops here the bus.*	Here Humberto uses the correct 'a' sound that would apply to the plural conjugation in both the singular and the plural version of the sentence, hereby overgeneralizing the feedback he received
11 C: Meine Schwester lässt den Hund ins Haus. Meine Eltern ihr lässt den Hund ins Haus.	*My sister lets the dog into the house. My parents you let the dog into the house.*	Claudia moves on to the next sentence and uses the correct conjugation for singular, however not for the plural version of the sentence
12 H: Entschuldigung wo hält hier der Bus.	*Excuse me where does the bus stop here?*	Humberto corrects his sentence after thinking about it and hearing Claudia's example
13 C: sigues tú	*It is your turn*	Claudia tells Humberto to continue with a new sentence
14 H: Ich schlafe jeden Sonntagmorgen bis halb zwölf. Ich	*I sleep every morning until 11:30. I*	Humberto uses the correct conjugation for the first person singular
15 C: se ve como Dein	*It looks like your*	Combination out of Spanish and German
16 H: Dein Freund schlaft no	*Your friend sleeps, right? (combination of German and Spanish)*	
17 C: er	*he*	
18 H: ah	*aha*	
19 C: so it will be schläft	*Sleeps (third person)*	Claudia uses English here because A is circulating around the room making eye contact with C while listening to this group [Claudia explained her language choice here while reviewing this transcript as part of her interview]
20 H: schläft. Dein Freund schläft jeden Morgen bis halb zwölf.	*Sleeps. Your friend sleeps every morning until 11:30.*	

21C: ah schläfst du auch am Wochenende so lang, it would be if it is ihr it doesn't have the Umlaut?	*Aha do you sleep so long on the weekends, too.*	Claudia directly asks the teacher for reassurance. In the question Claudia asks about the second person plural and that it doesn't have an Umlaut.
22 A: right		The instructor A is still listening to this group and affirms C's statement
23 C: so here it would be schlaft ihr, schläfst du auch am Wochenende so lang	*Do you all sleep, do you also sleep long on the weekend?*	Claudia is still using English in the conversation with A, who is nodding at her response. Claudia is correctly using the singular and plural conjugation
24 H: Tante Bettina traegt elegante Kleider	*Aunt Bettina wears elegant clothing*	
25 C: du	*you*	
26 H: es lo mismo Tanta Bettina porque du es lo mismo du es traegst	*it is the same aunt Bettina because you is the same you wear*	Combines Spanish with German
27 C: du se Tante Bettina es sie	*You aunt Bettina is she*	Spanish sentence structure is used with German words incorporated because the sentence is discussed
28 H: oh entonces Tante Bettina tragt elegante Kleidung	*Oh so aunt Bettina wears elegant clothing*	
29 C: aha		
30 H: Tante Bettina tragst	*Aunt Bettina you wear*	
31 C: du Tante Bettina es du	*You aunt Bettina it is you*	Claudia is following a Spanish sentence structure with "es" and uses the German words from the example to explain to Humberto that
32 H: Tante Bettina du tragst	*Aunt Bettina you wear*	
33 C: No, estoy diciendo	*No, I am saying*	Claudia is using Spanish when explaining something to Humberto
34 H: du tragst elegante Kleidung. Tante Bettina tragt elegante Kleidung porque	*You wear elegant clothes. Aunt Bettina wears elegant clothes because*	The "porque" is added to the German in Spanish indicating that he understood what Claudia was trying to explain to him earlier in Spanish
35 C: Robert trägt oft Uni Sweatshirts.	*Robert often wears university sweaters*	Claudia corrects the pronunciation of trägt
36 H: Robert trägt oft Uni Sweatshirts	*Robert often wears university sweaters*	Humberto repeats after Claudia with the correct pronunciation
37 C: si es trägt pero es more traegt asi	*Yes it is trägt but it is more like that traegt*	Claudia gives feedback in Spanish and English on how to improve the a umlaut pronunciation
38 H: Okay I get it.		Humberto got the concept and acknowledges that he understood it in English

Line 37 in this example shows a language combination out of Spanish German and English applied in one statement while Claudia is explaining to

Humberto how to pronounce the third person singular conjugation of "tragen" which is "trägt". Because Claudia has used one English word to address Humberto he replies in English in line 38 which is a deviation to the rest of their conversation that is carried out in Spanish and German. Garcia (2009) explains that multilinguals use one linguistic repertoire for their communicative needs, and this is what can be observed in the conversation between Claudia and Humberto. They both know Spanish and English and are learning German. While they are practicing forming German sentences they discuss the correct use of the conjugations in Spanish. The spontaneous language use in this group above shows that the two students are drawing on their full linguistic repertoire to make sense of the task at hand. Claudia draws connections between cultural identity and language use during her interview:

> "On my Kindergarten here, my mom wanted me to speak English so she put me in a really weird school that they only spoke English and they were like a Lutheran school cause there were only white people there were no Latinos or anything" (Interview 03/19/2018).

Due to the fact, that Claudia was placed in an educational setting of English-only speaker she was exposed to English early. Her comment here reveals that she connects "white people" with being monolingual English speakers. Claudia describes her language use with friends in the following way:

> "With my childhood friends I always speak Spanish most of them they don't speak one word in English they don't even know how to speak English which is weird because they live on the border, so I think it is kind of weird" (Interview 03/19/2018).

Living as a transfronteriza, a person who crosses the border frequently allows Claudia to understand the mentalities of people on both sides of the border (Esquinca, 2013). She speaks both Spanish and English and expresses a disbelief that her childhood friends are not bilingual like herself.

Excerpt 2 is from the German 2 class where I go through a list of vocabulary and ask the students to go over the list with a partner to find the plural of the nouns that are shown in singular. Lino and Carlos frequently work together and translanguage to make sense out of German vocabulary.

A: Annabell (instructor)
C: Carlos
L: Lino
Spanish is <u>underlined</u> in the original utterance and the English translation

Table 2. Excerpt 2 In-class Conversation

Utterance	**English translation**	**Explanation**
1 A: die Kaufhäuser okay so the au with the Umlaut is almost gonna be the oy as in boy, die Kaufhäuser, der Verkäufer, die Verkäuferin, and then die Verkäuferinnen so those are the ones that we will be focusing on, so go ahead and go over the list with someone ask how would you say the plural and how would you say it. For that side we will do a minute and then we will switch	*the sales person (male and female)*	Teacher is showing students a list of German vocabulary and gives directions
2 L: Qué tenemos que hacer?	*What are we supposed to do?*	Lino and Carlos usually work together and talk in Spanish to each other here Lino asks Carlos
3 C: Tenemos que leer el lado izquierdo y derecho	*We are supposed Read the left and right side*	Carlos answers and gives a translation of the directions that were given in English
4 L: Entonces	*Ok then*	
5 C: Frauen, Fraunen o Frauen?	*Women or women*	Carlos is unsure how to pronounce women in German so he is asking Lino.
6 L: Frauen	*women*	Lino gives the correct pronunciation
7 C: Frauen, das Kleidergeschäft (Gliedergeschäft), die Klamotten [Lino is also reading it]	*Women, the clothing store, the clothes*	Carlos is reading the K as G in department store which is common in some German dialects
8 L: die Klamotten. Estamos viendo cómo se escribe en plural y en normales	*The clothes. We are seeing how it is written in plural and in normal*	
9 C: Y luego	*And then*	
10 A: Verkäufer is male, Verkäuferin is female	*Sales person is male, sales lady is female*	The instructor gives the singular for sales person masculine and feminine
11 C: ah era feminino	*Aha it was feminine*	Carlos affirms that he understood what was being said in English with his utterance in Spanish that is a form of inner speech that he happened to say out loud to himself
12 A: die Verkäuferinnen	*The sales ladies*	
13 C: Oh sí era plural	*Oh yes it was plural*	Carlos demonstrates understanding of what

		instructor said in this utterance in this form of inner speech
14 A: Okay, I'll let you work on these words so ask each other for the combinations		Teacher provides more directions in English
15 C: Tenemos que traducirlos unos, no?	*We have to translate some, no?*	Carlos now asks a rhetorical question
16 L: Qué, qué?	*what, what ?*	Lino did not understand the directions given in English
17 C: Tenemos que traducirlos, haz de cuenta, yo te pregunto ah cómo se dice "loud"	*we have to translate, do not tell me I ask you how do you say loud*	But Carlos did understand the directions and now translates the original directions to Lino. Carlos is using Spanish but is using the English loud to elicit the German translation
18 L: loud		Lino repeats loud in English
19 C: pero te pregunte en inglés y tú me respondes en alemán	*But I ask you in English and you answer me in German*	Carlos explains in Spanish that he is looking for the German
20 L: Ah, laut	*Aha loud*	Lino understands what he is supposed to do and gives the German translation
21 C: Y tú me preguntes a mi	*And you ask me*	Carlos continues to give directions in Spanish
22 C: to take nehmen miralo yo pensé que esa etaba mas relacionada con nombre	*To take look at that I thought that nehmen was more related to name*	The group discussed that it could be related to the word "name" in English which is also written as "Name" in German.
23 L: Yo también	*Me too*	
24 C: Porque esta tiene h es por eso porque se viene de nehmen creo ich nehme	*Because this one has an h that is why it comes from to take I think I take*	Carlos demonstrates metalinguistic awareness in this multilingual vocabulary inquiry.
25 L: la que hicimos el nehmen con h	*What we did to take with h*	
26 C: ah		
27 L: sehen	*To see*	
28 C: to become		
29 L: hmm?		
30 C: to become		
31 L: werden (rolling r)	*To become*	
32 C: werden creo que ja	*To become I believe that yes*	German and Spanish are both used in this utterance

		ja is German for yes
33 L: Entonces qué hacemos?	*Then what do we do?*	Lino is asking for clarification on the task in Spanish
34 C: Lo mismo, to bake	*The same, to bake*	
35 L: backen, er bäckt	*To bake, he bakes*	
36 C: Bueno to drive	*Good*	The feedback is provided in Spanish then in English, Carlos is asking for "to drive"
37 L: qué?	*what*	
38 C: conducir	*To drive*	They had agreed to ask each other in English for the German translation and are using Spanish here because Lino did not understand when asked in English
39 L: to drive er fährt, to eat	*He drives*	Lino can give the answer in German
40 C: to eat era essen	*To eat was to eat*	
41 L: essen, er isst	*To eat, he eats*	
42 C: zahlen bezahlen no se es esta curiosa aver to run	*To pay I don't know it is curious let's see*	
43 L: to run laufen		
44 C: Yo pensaba que era como que laugh para la risa no es to wash	*I thought it was like for laugh it is not*	Making associations between German words when trying to understand their meaning
45 L: waschen, er wäscht, to bake no ya te la marque to get	*To wash, he washes, to bake, I already marked it, to get*	
46 C: to get bekommen		
47 L: mmh donde esta?	*Where is it?*	
48 C: to need hasta arriba bueno	*At the top good*	
49 L: brauchen, to read		
50 C: leer, ah ya le vi, lesen er liest aver to sleep	*To read I saw it, to read he reads let's see to sleep*	Spanish translation from English is given before the German translation
51 L: sleep?		
52 C: schlafen y no se decirlo to sleep pero Plautdietsch	*To sleep and they don't say to sleep in low German*	Carlos is familiar with Plautdietsch a German dialect that is spoken by the Mennonites a religious community living in Chihuahua, Mexico

53 L: Plautdietsch cual es ese?	*Low German which one is that?*	
54 C: El aleman bajo de los Menonitas	*The low German of the Mennonites*	
55 L: aha		
56 C: Se diece mischläft se dice que tiene sueno	*They say …when one is tired*	Carlos is sharing his knowledge of Plattdeutsch with Lino
57 L: pero de dónde aprendiste eso? C: de Monika L: si se cierto	*But where did you learn that* *From Monika* *Yes that is true*	Lino is wondering why Carlos knows it in Plautdietsch and he reminds him because of Monika, his girlfriend who grew up in the Mennonite community speaking the German dialect, Spanish and English

Lino and Carlos are translanguaging for meaning making and show that they comprehend what is being said in English and German by the teacher by making their connections to the German vocabulary in Spanish for example in utterance number 11 and 13. In line 16 Lino is expressing confusion about the directions that were given in English but because the two students were grouped according to their home language which is Spanish Carlos was able to quickly clarify the directions and the of them were able to complete the task at hand Starting with utterance 22 Carlos and Lino are discussing that to them that the German verb "nehmen" has resemblance to "Name" phonetically when pronounced in English the word name sounds similar to "nehmen" when pronounced in German this multilingual vocabulary inquiry shows that the two students are drawing on their full linguistic repertoire (Garcia &Wei, 2014). During their interviews the participants stated that they used both English and Spanish to make sense of German.

Starting with line 51 until the end of Excerpt 2 a discussion around Plautdietsch unfolds because after being asked for the translation of the verb to sleep Carlos draws a connection to this low German dialect that he also happens to be familiar with. This Excerpt 2 shows that students who are given the possibility to use their full linguistic repertoire will be able to draw on knowledge that is tied to their cultural identities and that of their respective communities. Being able to make these connections enriches the German language learning experience, because students can make meaning of the new language by building on existing background knowledge (Garcia & Wei, 2014). Claudia, Humberto, Carlos and Lino made connections between cultural identity and language choices.

Students identifying as Mexican-Americans in this study are showing a different language use pattern compared with those who self-identify as Mexicans. Below is an example of two students who self-identify as Mexican-American and have knowledge of both English and Spanish but prefer to use English in the

classroom. This activity took place after spring break and students were asking each other how they had spent spring break. Iskra and Jay are holding their conversation in German and use English to ask questions and explain what is being said, as well as to translate back into German.

Iskra=I
Jay=J

Table 3. Excerpt 3 in-class Conversation

Utterance	English Translation	Explanation
I: Wo warst du in den Frühlingsferien?	*Where were you during sprink break?*	
J: Ich war in Las Vegas.	*I was in Las Vegas.*	
I: Kennst du oh you ask me	*Do you know…*	Explanation of the task is given in English
J: Kennst du Las Vegas?	*Do you know Las Vegas?*	
I: Ja ich kenne Las Vegas.	*Yes I know Las Vegas.*	
J: Ah, warst du schon in Las Vegas? [Pause 2 seconds]	*Have you been to Las Vegas?*	
I: What's that?		Question about meaning is asked and answered in English
J: Have you been in Las Vegas before have you been to…		J is trying to explain to I what he has just asked her in German
I: Ah		Iskra did not understand the question in German and is looking for the question in the textbook
J: It's over there.		J assists in pointing out where to look for the sentence structure
I: Ja, ich war in Las Vegas.	*Yes I was in Las Vegas.*	
J: Gefällt dir Las Vegas?	*Do you like it?*	
I: Ja, Las Vegas gefällt mir.	*Yes, I like Las Vegas.*	
J: Those are the questions. So I'll ask you okay? Wo warst du in den Frühlingsferien?	*Where have you been during spring break?*	
I: Ich war in ah Cancun.	*I was in uh Cancun.*	
J: You say: Kennst du Cancun?	*Do you know*	The directions were to get a conversation going so J tells I to ask a question
I: Kennst du Cancun?	*Do you know ...*	
J: Ahm nein ich kenne Cancun nicht.	*No I don't know ...*	

On the topic of classroom atmosphere Claudia states:

> "I find every activity helpful cause it's very interactive not just sitting there and listening to someone talk and I don't know I like the way the class goes. And I think that is why people actually go even when you don't take attendance and stuff like that normally classes get emptier and emptier cause people don't go but German class is always full, I think it's because people like it. I'm always excited to go because I think I'm actually going to learn something" (Interview 03/19/2018)

Jay commented the following on the classroom environment: *"over here it is always relaxed, and I always have fun"* (Interview 03/19//2018)

The interviews reveal that the participants reflect positively on the set-up of the class which they describe as comfortable and conducive to learning. One element that participants mentioned was the positive effect of collaborative group work for their learning. Jay is a student who spoke Spanish and English languages did not identify as bilingual because he is applying a different standard to himself.

> "I would say I know one language so I'm not bilingual but I know a lot of Spanish but not enough to be bilingual" (Interview 03/19/2018).

This understanding of biliteracy reflects a monolingual view on languages Jay judges his abilities in Spanish according to an internalized deficit discourse. According to this standard his Spanish does not measure up with his English.

At the same time Jay states the following when asked how he makes sense out of new German vocabulary:

> "I usually use English but if I am trying to figure out a word that is when I go to Spanish or I know how to say the letters instead of English with the ch and the sh I go to Spanish and it makes it a lot easier to think "(Interview 03/19/2018).

Although he is able to use Spanish to make sense out of German he does not self-identify as bilingual. Jay's mother is Mexican and his father American he self-identified in the following way: "I'm American but I'm of Hispanic descendance" (Interview 03/19/2018).

Jay identifies as American now connections can be made between discourses of Americans being English only speakers and his own self-image as a monolingual American (Hornberger, 2002). Claudia talked about Mexican-Americans who do not use their Spanish language skills:

> "because for here speaking Spanish makes you, I don't know people see it as it is better to pretend you don't speak Spanish it's like a bad thing I don't know why so maybe they are always trying to not speaking it but I mean it is their first language and at home they speak it and sometimes it is so weird because I see parents speak in Spanish to their kids and kids answering in English and I don't get it maybe it is the way I was raised because I always see it as instead of wanting more you want less" (Interview 03/20/2018).

In this comment on Spanish the passing for white theme emerges particularly since speaking Spanish is often associated with an immigrant community and it is a marker of non-whiteness. Nativist discourses are present in the border and are noticed by the participants. "The power I have seen: white people that are like 'why are you speaking Spanish here? Speak American here.'" (Interview 03/22/2018)

Within the group of participants, it can be noticed that language shift, as well as language loss have been going on. The group of students who are German heritage language learners have all been experiencing language shift first hand. They described that their German-speaking mothers would switch to speaking in English once they moved from Germany to the United States. Consequently, English became the language that was dominantly spoken at the expense of German. Language shift and loss can also be observed within the Mexican-American and Latina/o participants. As English became the more dominant language in their families over time, particularly, with a bilingual educational system that transitions students towards speaking English as their dominant language. Within the group of heritage language learners of German only one person used German consistently together with English at home. The other heritage language learners would hear it only in conversations with grandparents but would rely on translations to English.

Table 4. Excerpt 4 In-class Conversation

Utterance	**Explanation**
Adrian: So I guess we can use this time to talk about how German relates to other languages I guess. Cuz the sentence structure is very similar to Spanish.	This group had completed their task ahead of all the other groups so Adrian has the idea for this metalinguistic conversation
Stephanie: Yes.	Self-identifies as Mexican-American based on her interviews
Jarid: I don't speak Spanish so I don't know.	Jarid was born in Germany and has been speaking English all his life
Jonathan: I told you my background in Spanish.	Although of Spanish-speaking decent Jonathan does not speak Spanish
Adrian: Wait, I know Spanish and you don't get along together.	
Jonathan: Haha (laughing)	
Adrian: It was my first language, I learned Spanish and then I learned German at the same time …	Adrian attended an elementary school where he was able to take German every year
Jarid: Oh, that is awesome. Adrian: Yeah	
Stephanie: I speak Spanish and English (laughing)	
Jonathan: Like me. The most I notice Spanish is when my grandmother is cussing me out and that is at on a daily basis. Group is laughing	The grandmother is Spanish-speaking while Jonathan will respond to her in English as he explained during his interview

Table 5. Excerpt 5 In-class conversation

Utterance	**English translation**	**Explanation**
Shawn: Regnet es am Südpol?	*Does it rain at the south pole?*	
Andre: Nein, am Südpol regnet es nicht.	*No, at the south pole it does not rain.*	
Shawn: Mmh (noding) Andre: Schneit es oft in Houston?	*Does it snow in Houston?*	Shawn is approving sentence Andre just told him
Alex: Nein, scheint es nicht oft in Houston.	*No, it does not shine often in Houston.*	Schneit and scheint are often confused by German learners
Shawn: schneit	*snow*	Shawn did notice the mistake and is correcting Alex
Alex: Nein, es schneit	*No, it snows*	Alex is using the correct verb but hesitates completing the sentence
Shawn: nicht oft	*Not often*	Shawn is helping him
Alex: nicht oft in Houston. Regnet es in Israel viel?	*Not often in Houston.* *Does it rain much in Israel?*	Alex is completing the sentence with the help provided
Andre: Nein, in Israel…	*No, in Israel*	Andre gets stuck with his sentence
Shawn: …regnet es nicht viel	*It doesn't rain much*	Shawn is helping to complete the sentence the focus of the activity was on the negation
Andre: nicht viel	*Not much*	Andre is repeating the negation part but without the verb
Shawn: I think it is regnet es nicht viel	*I think it is does it not rain much.*	Shawn provides feedback
Andre: In Israel regnet es nicht viel.	*In Israel it does not rain much.*	Andre repeats what Shawn had told him
Shawn: Ist der Winter in Italien sehr kalt?	*Is the winter in Italy very cold?*	
Andre: nicht Winter ist kalt	*Not winter is very cold*	Andre answers with this sentence fragment
Shawn: Nein, in Italien der Winter ist nicht sehr kalt.	*No, in Italy the winter is not very cold.*	Shawn gives the complete negation as a sentence
Andre: Nein, in Italien der Winter ist sehr kalt, ist nicht sehr kalt. Beginnt der Sommer im Julei Juli?	*No, in Italy the winter is very cold, not very cold. Does the summer begin in July?*	Andre repeats the sentence, he has trouble pronouncing Juli
Alex: Nein, der Sommer beginnt nicht im Julei.	*No, the summer does not begin in July.*	
Andre: Is it Julei or Juli?		Andre is confused as to how to pronounce Juli
Shawn: Juli		correctly pronounced

Students like Iskra and Jay described that they feel more comfortable with using English since that is what they have been socialized into throughout their academic careers. Although Spanish might be heard at home these students did not consider Spanish to be an academic language that they felt comfortable using in an academic setting.

The following example is from a group in the German 1 class that consists of students who partly identify as Americans and as Mexican-Americans. This meta-linguistic discussion is an example of how students describe themselves based on their language use. During the interviews that were conducted as part of this study all participants had the chance to self-identify and make connections to their identity based on the command of languages they have. Jarid, although born in Germany, identifies as American because he "only speaks American" which hints at a nativist discourse of associating American with the knowledge of English-only, while others hyphenated their identities based on the language they speak. Stephanie in the excerpt below talks about speaking Spanish and English. In her saying she speaks Spanish and English she shows consistency also during her interview she identifies as Mexican-American and bilingual. Jonathan and Adrian both identify as American with Spanish "descendants" a term they used during their interviews.

Students identifying as American were using English for their communicative needs in the German class. In the example below Shawn could be classified as a heritage German learner. His group relies on his knowledge and trusts his feedback although he did not have formal instruction in German he has been exposed to it through his German grandparents and his German mother. He is a resource for his group because he is able to help them to identify mistakes in their German phrases. Moreover, Shawn can give feedback to the group members that they are able to incorporate while practicing their sentences.

The excerpt below is an example of a group conversation with another German heritage language learner Evan. In Excerpt 5 Shawn is a German heritage learner who is a resource to his group and offers feedback to his group members. In Excerpt 6 Evan identifies as English only speaker although his father is Mexican and his mother has German ancestry; however, Evan speaks only English because as he describes: "I would usually kind of ignore Spanish just because I was arrogant … I only knew English so I was like: ah whatever." Evan made this reflection about previous opinions he had about Spanish indicating that there might have been a change. The conversation below is an example of the group practicing how to tell time in German, and Evan translanguages between German and English when it is his time to speak. The activity involved reading time in German; different clocks were shown and students had to ask each other for the time and read the clocks in German. Time is told differently in German compared to English and his group is explaining that to Evan by modeling it. Nico and Victor are two bilingual speakers who are very comfortable speaking in Spanish to each other. Mario is more comfortable speaking English but has knowledge of both Spanish and English; the common language that is used to explanations here is English. Evan's opinions about not wanting to speak Spanish have lead him to lose the Spanish he knew as a young child. He always ignored Spanish because it was

not interesting to him as he explained during his series of interviews his preference for English determined the language of choice for this group of students who might chose to work in Spanish if he was not present. Complex identities around languages are common in the German classes at this border university because the class becomes a space to reflect on other languages one might know or used to know and it draws attentions to discourses and believes and ideologies about languages and the value of language. Evan explained that although Spanish was heard frequently either on his Dad's side of the family or in the community, he did not feel the importance of knowing Spanish as a consequence he cannot communicate well with his grandmother.

E: Evan
M: Mario
V: Victor
N: Nico

Table 6. Excerpt 6 In-class Conversation

Utterance	**English Translation**	**Explanation**
E: So, I don't understand it		Evan is confused with the way time is told in German
M: You just read it.		Mario is trying to give him a hint
E: Okay so		
M: it is six fifty five instead of five minutes to		Mario continues to explain more of how time is read
E: Okay. Wie viel Uhr ist es?	*What time is it?*	
V: Es ist zwanzig Uhr fünf	*It is 20 minutes until 5*	
E: Es ist sechs fifty five Uhr	*It is six fifty five o'clock*	Evan starts his sentence in German and includes English and completes the sentence in German
N: Sechs Uhr fünfundfünfzig	*Six o'clock fifty five*	
M: Wie viel Uhr ist es?	*What time is it?*	
V: Es ist siebzehn Uhr zwanzig. Wie viel Uhr ist es?	*It is seventeen o'clock twenty. What time is it?*	
E: Es ist drei thirtynine	*It is three thirtynine*	Evan starts in German and uses the English numbers because he is not sure how to read time in German
N: You put the last number first and then you say let's say		Nico gives an explanation of how to read the numbers
E: Es ist zwanzig nach drei	*It is twenty past three*	Evan is using German to read the time correctly

Quejona is a German heritage language learner who is exclusively using German in the class. At her home both German and English are spoken. Her

grandma is from Germany and has traveled to Germany often. The excerpt below is from a class activity in which modal verbs were practiced. In the conversation below I asked her for something that she must do and for something that she would like to do, so that the rest of the class could hear an example for each of the two modal verbs.

Table 7. Excerpt 7 In-class Conversation

Utterance	**English Translation**	**Explanation**
A: Und du? Was sollst du machen?	*And you? What are you supposed to do?*	Modeling modal verbs use in a question for the rest of the class
Q: Ich soll nächsten Samstag zur Arbeit gehen.	*I'm supposed to go to work next Saturday.*	
A: Was möchtest du machen?	*What would you like to do?*	
Q: Ich möchte wieder heim gehen nach Deutschland.	*I would like to go back home to Germany.*	When asked what she would like to do, Quejona gave this example thereby showing that she still has strong ties to Germany and she considers it to be her home, as she explained during her interviews
A: Okay.		

Discussion

The goal of this case study was to find out how bilingual learners are making sense out of learning German, and it can be said that a translanguaging pedagogy was useful in creating a classroom environment that was conducive to learning. Similarly to other translanguaging research this study shows translanguaging as a successful strategy to promote language acquisition and as a strategy to integrate and include students (Hornberger & Link, 2012; Collins & Cioé-Peña, 2016; Makalela, 2015). Collins & Cioé-Peña (2016) describe that through multilingual collaborative group work emergent bilingual students are given the opportunity to translanguage, which contributes to the development of a more assertive identity, which could also be noticed with the participants in this study. Translanguaging can contribute to both the empowering of students and to their development of self-confidence. Students in this study demonstrated a deep understanding of the new content they were learning. They used translanguaging to include other students, demonstrate their knowledge and co-construct meaning and mediate understanding among each other (Garcia & Wei, 2014, p. 82).

Claudia, Lino, Adrian, Carlos, Iskra, Stephanie, Andre and Humberto all participated in either bilingual or dual language programs throughout their educational journey and identified as bilingual. Of this group Iskra and Adrian went to a school that was even emphasizing a third language in addition to English and Spanish they took German from Kinder until 8th grade. Claudia finished high

school in Ecuador. Lino had been going to school in Brazil and speaks Portuguese in addition to Spanish and English. Humberto went to a middle school and later high school serving students with low-socio economic status at the border, in a school district that was affected by a testing scandal (Reyes, 2016). Creating a classroom atmosphere in which all students feel validated and respected regardless of what languages they speak or what socio-economic background they have is an important foundation to facilitate the learning process of learning an additional language. As a participant of the study and the instructor of the German classes I would model translanguaging as a strategy for learning by opening the classroom space for social interactions and peer grouping students according to their language repertoire encouraging collaborative dialogue (Garcia, Ibarra-Johnson, & Seltzer, 2017). As the instructor I do not monopolize the classroom time with lengthy explanations of how language concepts work, but rather students try out new concepts after seeing them modeled. Furthermore, students know that they can rely on their group members for help and explanations as well as on my feedback as I circle around the classroom interacting with groups.

The time in class is organized around interactions, while interactions in a language class can be artificial or constructed, I aim to get to know students well so I can ask them questions regarding their life and interests to create an authentic exchange. As a German person I share my culture with my students in the classroom but also through inviting them to explore and make connections with the local German community. For example, I share German holidays with students through celebrations in the community, but I also make connections to the local culture by celebrating holidays such as Dia de los Muertos. Making authentic connections to the students' knowledge and their cultural backgrounds builds trust and opens up the space for learning. Translanguaging as an approach "recognizes the complexity of people's everyday spaces and multiple resources to make sense of the world" (Garcia & Wei, 2014, p. 24). Participants of this study used translanguaging to make sense of German (Garcia & Wei, 2014)

A limitation of the study is that I am the researcher and also particpant of the study so my double role might have influenced the participants. However, all participants had volunteered to parttake in this study and had the option to dicontinue the study at any point. All participants remained in the study. Participants gave positive feedback that they were enjoying being part of this research process and that the topic and research focus was meaningful to them. Students seemed genuienly excited to share about themselves during the interview process. Students also took an active role throughout the research guiding the discussions addressing whichever topic they felt was important to them one example for that is Excerpt 4. All participants were in control of their recording devices while in the class. Furthermore, a member check took place every participant was able to see their transcribed conversations and was able to give their perspective. Through this process data was triangulated thereby giving control to the participants. Althouhg this study was conducted during one semester due to the fact that I have a double role of researcher and participants I was able to follow the same group of students over the course of two years and have first hand insight into how their German language developed over the course of time.

Therefore a longitudional study might be useful to show how a translanguaging pedagogy can assist language development.

Conclusions

The German classes at a borderland university that were at the heart of this qualitative study highlight the intersectionality of language use, language identity, and ideology. Deficit discourses have influenced the participants of this study, consequently the Mexican-American students in this case study were feeling self-conscious about using Spanish to make sense of German, in a classroom setting with Mexican students who speak Spanish at home and have been educated in Mexico. The transfronterizo students who cross the border on a regular basis were adjusting their language use to their interlocutors, but spoke Spanish exclusively among themselves. They did not favor a perceived mixing of the two languages English and Spanish, which they described as a common practice taking place on the American side of the border. Ultimately learning German through a translanguaging pedagogy was a catalyst of becoming more aware of language ideologies that have previously not been reflected on. Translanguaging can contribute to decolonizing notions of language purism. As Razfar & Rumenapp (2012) show in their study making language ideologies explicit can open space to question and counter them. Participants in this study verbalized language ideologies thereby allowing a process of reflection on them. Through their respective language choices participants portrayed their language identity which is underpinned by notions of language identity. According to Garcia and Sylvan (2011) it is possible to overcome monolingual language ideologies through translanguaging. In the case of this study the monolingual language ideologies were uncovered and reflected on; however, using a translanguaging pedagogy alone is only slowly changing those long-held believes students bring to the classroom. Particularly if they have been acquired over a long period of time. What seemed to be powerful for the participants of this study and motivated them to participate was the fact that I have a genuine interest in their backgrounds and culture and family heritage and knowledge that I demonstrate every day through interactions in the classroom. Similarly, to Rios (2013) study students' knowledge was made visible trough the interactive work in the classroom. Learning German allowed that space of reflection on dominant language discourses. As Anzaldua (1987) states students can learn to become conscious of those discourses. The translanguaging classroom can thereby become a space without linguistic, national and cultural borders a space for transformation (Garcia & Wei, 2014, p.43).

Future research can investigate that potential for decolonization of knowledge and identities. Through translanguaging practices it became visible that one utterance can represent "the juxtaposition and intermixing of two different and potentially conflicting worldviews, styles, social languages, accents, or voices" (Cervantes-Soon & Carrillo, 2016, p. 290).

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Indonesian Educators' Knowledge and Beliefs about Teaching Children with Autism

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There is a large number of children with autism who need to be taught within the Indonesian education system. A significant influence on how their needs are perceived are the epistemological and cultural beliefs of teachers. This research is the first to examine these issues in the context of the Indonesian government's intention to develop an inclusive education system. An analysis of 136 questionnaire responses from teachers and educational therapists indicated that although only a minority was aware of, or had been trained in, established autism interventions, children with autism are being taught within Indonesian schools. This included being taught within regular schools. The data suggest that having access to information about autism in the Bahasa Indonesia language plays a role in educators' beliefs about the stigmatization of teachers and parents of autistic children. Teachers' epistemological beliefs were found to be linked to their beliefs in inclusive education. This research suggests that is essential for educational research to acknowledge the influence of the cultural milieu within which inclusive education is being developed. The implications of this research for how the development of inclusive education can be supported within Indonesia are discussed.

Keywords: autism, inclusion, Indonesia, teachers' beliefs.

Introduction

Inclusive education is a world-wide movement, inspired by the Universal Declaration of Human Rights. At its heart is the shared belief in "education for all" where that all children, including those labelled as having special educational needs and disabilities, are able to have equal access to education with their peers. This belief is reflected in associated policies such as the Convention on Rights of People with Disabilities, which is explicit that "Parties shall ensure an inclusive education system at all levels ..." (Department of Economic and Social Affairs, 2011, Article 24). Indonesia is the most diverse multi-ethnic nation in the world (Direktorat Pembinaan Sekolloah, 2008) and the government has set the challenge of implementing inclusive education for all school-age children in light of the "Education for All" Agenda (Budiyanto, 2011; Ramos-Mattoussi & Milligan,

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2013). The beginning of inclusive education in Indonesia can be seen in 2001, when the Directorate for Special Education supported the first inclusive pilot school in Yogyakarta. Following this the Minister of Education's 2003 directive (the Direction Letter of the Directorate General of Primary and Secondary Education No 380/C.66/MN/2003) was for each region to develop at least four inclusive schools. This occurred in parallel to the Education Law 2003, which mandated free basic education for all and devolved school management to a local level. By 2008, 925 inclusive "pioneer" schools had been created (Sunardi, Yusuf, Gunarhadi, Priyono, & Yeager, 2011). Subsequent policies have endeavoured to facilitate inclusive education at national and regional levels. For example, a 2009 decree (Decree of the Minister of Education No 70-2009) stated that every district should have an inclusive high school and that every sub-district should have one inclusive primary and one inclusive secondary school. Block grants were given to support these schools [For detailed analysis of the development and range of policies see (Wibowo & Muin, 2018)].

In Indonesia, schools can be categorized as regular, inclusive or special, and all three have continued to exist (Aprilia, 2017). Regular schools typically do not admit pupils with disabilities or special educational needs. These children might be taught in 'Sekolah Luar Biasa' (special schools), which traditionally have been orientated towards specific disability categories such as deafness (Purbani, 2013). The devolvement of school management to local levels has created a wide variation in school admission practices across special and regular schools (Aprilia, 2017) and this is seen as having a negative effect on school access rates, particularly in rural areas (Kristiansen, 2006). This local government at district (kota) level applies to state education. However, all special schools are governed at the broader provincial level. In addition, there is a religious school system, governed by Ministry of Religious Affairs (MORA) (Suwaryani, 2008).

Whilst national laws may apply to religious schools, as with state schools, access by disabled children can be problematic (Afrianty & Soldatic, 2016).

One consequence of the inclusive education initiative is that children, who might previously have been excluded from education in regular and special schools (Tucker, 2013), are attending inclusive classrooms (Padmadewi & Artini, 2017). The majority of these children have intellectual disabilities (Sunardi et al., 2011). Given the co-morbidity between intellectual disabilities and autism (Roberts, & Williams, 2016; Tekola et al., 2016), it is likely that many children with autism are now attending inclusive schools. Children who are given the diagnostic label of autism, or the more recent category of autistic spectrum disorders (ASD) (Roberts & Williams, 2016) will experience a severe impairment in their reciprocal social interactions (Baxter et al., 2015). Although these characteristics vary significantly between individual children, the majority will have some form of intellectual disability (Herring, 2016).

There is relatively little research regarding autism in Indonesia (Febrian Kristiana & Widavant, 2015) and no definitive national picture of how many children in Indonesia are affected by autism (Sakya, Santosa, & Bagus, 2017). This is partly because of differing diagnostic practices, and significant variations in access to opportunities for a diagnosis across such a geographically and culturally

diverse nation (Sidjaja & Newcombe, 2016) However, it is certain that there are a large number of children with autism in Indonesia. The main epidemiological study, to date, occurred in Yogokarta, one of the nation's largest cities, and indicated a prevalence of autism (for children born between 1984 and 1991) of 12/10,000 (0.1%) (Wignyosumarto, Mukhlas, & Shirataki, 1992). Although this epidemiological research has not been replicated (Riany, Cuskelly, & Meredith, 2016; Sidjaja & Newcombe, 2016), there is some evidence that the diagnosis of autism in Indonesia has subsequently increased (Tucker, 2013). This is in line with recent global reviews, in which rates of autism in children are much higher than previously thought, partly because diagnostic approaches have become more widely used worldwide (Roth, 2017). Estimates of the incidence of autism vary over time and also between countries (Baxter et al., 2015) For example international estimates range between approximately "one in every 150 children" (0.67%). (Riany et al., 2016, p. 2) to one in one hundred (Department of Health, 2013), to 1.14% of all Indonesia's 237.5 million people (Lestari, Herini, & Gamayanti, 2017). The various estimates have been accompanied by an increased awareness of autism, reflected in an increasing number of alternative therapy centres for autism (Windiani, Soetjiningsih, Adnyana, & Lestari, 2016), several government and health organizations providing family support, and 24 provincial autism centers (Lestari et al., 2017).

Comparative international research suggests that, in other countries, children with autism are being educated in settings that range across a mainstream-to-special school–excluded continuum (Rix, Sheehy, Fletcher-Campbell, Crisp, & Harper, 2013). Given the diverse nature of autism it is possible that many children with autism might attend regular Indonesian schools, however data on this issue is absent outside of a single case study report (Padmadewi & Artini, 2017).

It was reported in 2008 that there were 638,000 children, diagnosed with autism, in Indonesian special schools (Riany et al., 2016). However, there is a lack of more recent data on this issue (Bella, 2018) and so the current number of children with autism in regular, special and inclusive school settings remains unclear. This lack of clarity is exacerbated by a national situation in which there are low rates of birth registration, especially in rural areas. Many schools require these registration documents as a precondition for enrolment, and so children with disabilities from poorer rural families are excluded from school, and hence from identification within educational records (Sumner, 2015). However, the data that is available, although partial, indicates that there is a significant number of children with autism who will need to be taught within Indonesia's education system. This is a significant issue in relation to developing appropriate educational practices and support as Indonesia implements its policy of inclusive education.

The Inclusive Indonesian Classrooms project is a joint endeavour between the State University of Surabaya, Indonesia, and the Open University, United Kingdom. It aims to develop pedagogical strategies and teaching approaches to facilitate inclusive teaching (Sheehy & Budiyanto, 2014). Examination of effective inclusive practice highlights the importance of using social interactions as an educational tool (Littleton & Mercer, 2013; Rix, Hall, Nind, Sheehy, & Wearmouth, 2006). However, this way of teaching can only benefit children if

they can access the social interactions that mediate the classroom's curricular activities and resources. This is a profound issue for children with autism who experience difficulties with language and communication (UNESCO, 2009). This issue of autism has therefore become one focus for the Inclusive Classrooms project. A starting point for exploring this issue was a need to gain insights into Indonesian teachers' awareness of autism and different teaching approaches that are associated with autism, and their beliefs about where children with autism are best educated.

An enormous variety of teaching approaches and interventions are used internationally for children with autism, possibly more than associated with any other category of special educational need (Bond, Symes, Hebron, Humphrey, & Morewood, 2016; Guldberg, Parsons, MacLeod, Jones, Prunty, & Balfe, 2011). Regarding Indonesia, the current study reviewed publications between 2007-2017, that were accessible online and addressed interventions for children with autism in Indonesia. From this review 13 approaches emerged. A brief description of each approach is given in Table 1, with references to more detailed information.

Table 1. Teaching Approaches and Interventions Indicated Within Research Accounts of Indonesian Educational Practice for Children with Autism

Name of Approach	Brief Description
Applied Behaviour Analysis (Makrygianni, Gena, Katoudi, & Galanis, 2018) Lovaas Therapy (Jordan, Jones, & Murray, 1998)	These approaches are built on behavioural methods, typically breaking identified tasks into discrete steps and teaching these through reinforcing appropriate behaviors,
Treatment and Education of Autistic and related Communication handicapped CHildren (TEACCH) (Mesibov & Shea, 2010)	A key feature of this approach is examining how the child 'reads' their environment, and physically structuring the child's space to facilitate their learning. For example, through visual maps, schedules and symbolic representation of events.
Biomedical Intervention (Mire, Gealy, Kubiszyn, Burridge, & Goin-Kochel, 2017).	This category encompasses special diets, or dietary supplements, chelation, detoxification and interventions that are deemed helpful in addressing biomedical problems that have been suggested as linked to or underpinning autism.
Chinese alternative medicines (Tucker, 2013)	This includes reflexology, acupuncture and acupressure.
Javanese folk healing (Tucker, 2013)	This might involve buying and drinking herbal tonics and remedies.
Religious intervention (Fithri, 2011)	Religious practices and ritual that are deemed helpful to pupils with autism, and in improving their educational lives.
Floortime [Developmental, Individual- Difference, Relationship-Based (DIR)/Floortime] (Greenspan & Wieder, 1997; Pajareya & Nopmaneejumruslers, 2011)	An approach that focuses on facilitating meaningful interpersonal relationships, through spontaneous social interactions

Son-Rise Program (Williams, 2006)	Most usually used as a home-based parent-run intervention. It is a 1:1 child-led approach in which parents join in with the child's chosen activities.
PECS (Picture Exchange Communication System) (Bondy, 2012)	A systematic and structured programme to teach spontaneous social-communication skills to children with autism. It uses different types of symbols such as photographs and pictures to facilitate meaningful interactions.
Signalong Indonesia (Budiyanto, Sheehy, Kaye, & Rofiah, 2017; Jauhari, 2017)	This is a keyword signing approach developed in Indonesia to support inclusive class teaching in Indonesia. It also has a series of classroom communication symbols.
Sensory Integration (Ottenbacher, 1982)	Usually supported by Occupational therapists, this approach uses various physical activities to address neuropsychological dysfunctions, for example in relation to a child's processing of vestibular-related sensory information.
Gentle Teaching (McGeee & Brown, 1988)	A non-aversive approach to developing positive behaviors within respectful, safe, relationships.
Daily Life Therapy (Seikatsu Ryouhou) (Dempsey & Foreman, 2001)	This is a 24 hours curriculum which foregrounds the importance of physical activity to reduce anxiety and establish daily rhythms. Group dynamics are important and children develop these social skills within predictable daily routines.

Currently there is no research into Indonesian teachers' beliefs about teaching children with autism. The difficulties experienced by these children, their families and teachers are compounded significantly in countries where there is a low awareness of autism, combined with stigmatization and limited or developing service provision (Tekola et al., 2016). It is therefore important to research and understand these issues in relation to Indonesia and its educational system. A key influence on children's educational placement and experience is the belief of educators concerning whether children with autism require a specialist and separate educational placement to their peers. Indonesian children with autism have been a group at high risk of being excluded from education. This has been influenced by their increased likelihood of having severe learning difficulties, experiencing significant barriers to communication within schools, and the social stigmatization of disability (Riany, Cuskelly, & Meredith, 2016; Tekola et al., 2016). These factors can interact to create major barriers to educational access.

> "One founder of a private school for autistic children said to me that in a country where many typical children don't have access to education, education for disabled or autistic children "is not even seen as a responsibility, let alone a right" (Puspita, 2010, cited in Tucker, 2013, p. 54)

Consequently, there is a situation in which, even where special schools exist, they might not admit children with autism (Suwaryani, 2008). It has been suggested that a contributing factor to society's perceptions of children with

autism is a lack of Indonesian-language (Bahasa Indonesia) information (Adinugroho, 2010). Rainy, Cuskelly, & Meredith, (2016) concluded that

> "a large percentage of Indonesians still have little understanding about autism (and other disabilities) due to limited access to media and other health information. This is particularly likely to apply to those who live in small cities and rural areas" (Riany, Cuskelly, & Meredith, 2016, p. 2)

In the absence of access to information, the importance of existing cultural beliefs is magnified and can impact significantly upon how parents and teachers behave with regard to children with autism. However, " little is known about cultural beliefs regarding children with autism within Indonesian cultures" (Riany, Cuskelly, & Meredith, 2016, p. 1). Riany, Cuskelly, & Meredith's (2016) small qualitative study was the first research to examine parental beliefs in this area and uncovered a range of beliefs in which, for example, beliefs about taboo or the breaking of karma lead to the stigmatization of autism (Riany, Cuskelly, & Meredith, 2016, 2016). Their research concluded that awareness of these beliefs was important because

> "…the community's perceptions regarding autism will be influential in determining social and institutional responses to the needs of children with autism and those of their families" (Riany, Cuskelly, & Meredith, 2016, 2016)

Subsequently, research with seven caregivers in rural West Borneo found that their ability to care for their children was affected by negative attitudes and actions from their family and the community (Lestari, Herini, & Gamayanti, 2017). This included " verbal violence, violent threat, and keeping away from children with ASD [Autism]" (Lestari, Herini, & Gamayanti, 2017, p. 323)

Research into Indonesian teachers' beliefs is sparse and only one study, to date, has partly examined Indonesian teachers' beliefs about the nature of autism. Febrian and Widavant (2015) asked five open-ended questions to early childhood teachers, in Central Java. Two of these questions asked about their knowledge and experience of autism (Febrian & Widavant 2015). They found that approximately 88% of the teachers had no knowledge regarding autism. Those with some knowledge and experience believed that autism was 'the same as being crazy' (p 57). Febrian and Widavant (2015) concluded that there was a significant misunderstanding amongst the early childhood service teachers about the nature of autism. This current research emerged from discussions with teachers and is the first study to explore Indonesian teacher beliefs about teaching children with autism, and in relation to inclusive education. It sought to examine the relationship between teachers' epistemological beliefs and beliefs about the nature of autism, and to map the teaching approaches with which they are familiar. This research aimed to steer the directions of future research in the Inclusive Classrooms project and, more broadly, inform the training of teachers of children with autism in Indonesia.

Method

The Questionnaire

A questionnaire was developed to collect data about teacher's beliefs and knowledge (see Appendix 1). Q 1, 2 and 17 were based on questionnaire research examining Indonesian teachers' pedagogic beliefs (Sheehy & Budiyanto, 2015). Drawing on this research, three "teacher variables" questions were added to the questionnaire (Appendix 1, Questions 1, 2 and 17), which had been found to influential in relation to beliefs about inclusive and special education. Teachers beliefs epistemological beliefs have previously been researched using Questions 3, 4,6 and 8 (OECD, 2009; Sheehy, Budiyanto, Kaye, & Rofiah, 2017), and so these were included to consider social constructivist (Q3 and 4) and traditional direct transmission (Q 6 and 8) beliefs about learning. The notion of happiness of different types (*Senang* and *Suka*) has been suggested as a central issue for Indonesian pedagogy (Budiyanto, Sheehy, Kaye, & Rofiah, 2017), and so items 12 and 13 asked about this. The notion that autism is caused by parents who break a taboo or as the result of karma, has been identified as a common belief amongst the general public, and a significant factor in shaping people's responses to autism (Riany et al., 2016). Question 14 sought to find out the extent of these beliefs in this sample of Indonesian teachers. Previous research has identified that parents of children with autism (Riany, Cuskelly, & Meredith, 2016) and teachers of children with special educational needs (Budiyanto, Sheehy, Kaye, & Rofiah, 2017) can be stigmatized. Question 15 asks participants about this issue. There has been a rapid increase in the number of interventions and therapeutic centres for children with autism in Indonesia (Windiani, Soetjiningsih, Adnyana, & Lestari, 2016). However, many of these interventions are not evidence-based (Roberts & Williams, 2016). Furthermore, a long term ethnographic research study indicated that that many special education and regular school teachers may not 'have never heard of autism, let alone received training on how to educate autistic students' (Tucker, 2013, p. 56). Question 16 therefore lists interventions that have been identified as being used in Indonesia and asks teachers to indicate the degree to which they are aware of, or have received training in, each. Although a wealth of information about autism and teaching children with autism can be sourced online, an issue for parents and professionals has been access to good Bahasa Indonesia translations (Adinugroho, 2010; Tucker, 2013). Question 13 asks about the extent to which this situation exists for teachers. International research suggests that teachers commonly report a belief that they lack the skills to teach children with special educational needs (Rix, Sheehy, Fletcher-Campbell, Crisp, & Harper, 2013). Question 19 explores this issue in relation to Indonesian teachers and children with autism.

Question 20 asks teachers about where they feel children with autism are best educated and also about the belief that children with autism have special abilities. Research evidence suggests the latter belief can influence the former belief (Cassady, 2011). Question 21 examines the suggestion (Tucker, 2013) that parents' financial status is a major influence on having a child diagnosed with

autism and then obtaining an appropriate education or early intervention for them. Finally, Question 22 is an open question asking "What sort of training or information would be most helpful to you to support children with autism in your school?"

The research team comprised native Bahasa Indonesian and English language speakers. The questions were written in English and then back translated between Bahasa Indonesian and English. However, when creating and adapting questionnaires for different cultures "back-translation has moderate impact, whereas [an] expert committee helps to ensure accurate content" (Epstein, Osborne, Elsworth, Beaton, & Guillemin, 2015, p. 360). Therefore, the questionnaire translation was also discussed by an expert committee that included teachers, psychologists and a translator. The questions were then revised and mixed together to create a hard copy questionnaire.

Procedure

Ethics. The research followed the British Psychological Society ethical guidance (British Psychological Society, 2014) and was supported by the Ethics committee of the Open University. Each questionnaire contained information about the research project to support participants' informed consent.

Participants. The questionnaire was distributed at a national teachers' conference in East Java. Teachers from across Indonesia attended the conference, participation was voluntary and teachers could choose to return their completed questionnaires to boxes placed in the conference foyer. An estimated 350 people attended the conference, with 136 returning a completed questionnaire giving a return rate of approximately 43%. The majority of the sample was teachers (56%) or student teachers (28%), with a small number of others e.g. Psychologists (10%) and therapists (3%). The questionnaire respondents were working primarily in regular (30%) and (28%) inclusive schools, with 6% working special schools and approximately 20% categorizing their school type as "other".

Results

Over half of the participants (54%) had contact with autistic children as part of their professional role and 34% had contact with autistic children outside of their professional work. i.e. socially.

As might be expected teachers from inclusive and special schools were the most likely to work with children with autism (Pearson chi square, p=0.007 two tailed). Only 9 participants were from special schools and all but one worked with children with autism. However, 41% of teachers from regular schools also reported that they worked with children with autism

Previous research has suggested that professional contact is related to beliefs and attitudes towards children with special educational needs (Avramidis & Norwich, 2002). The current research examined this and also differences in relation

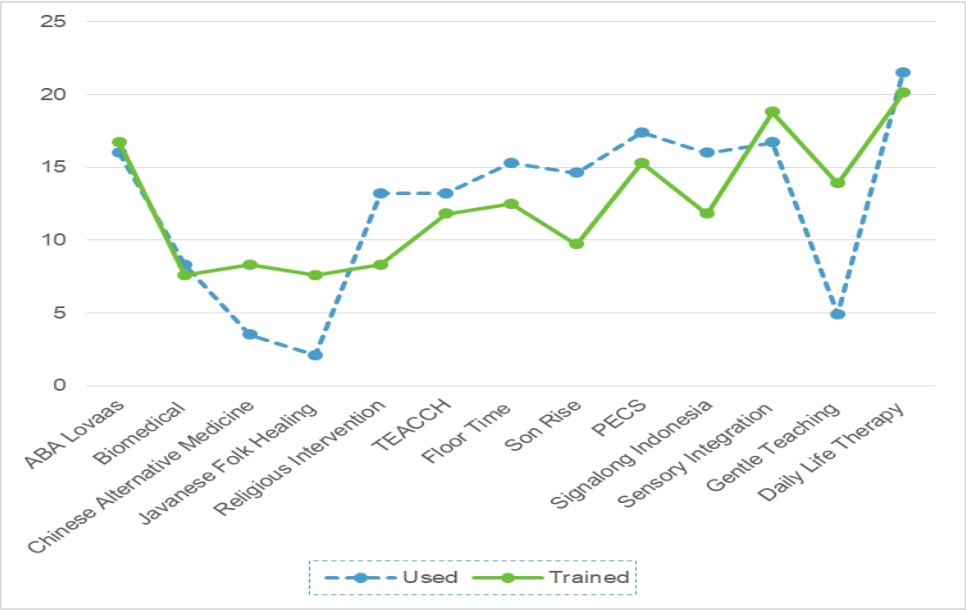
to experience of children with autism. Although nearly all (89.9%) respondents agreed that children have the right to education with their peers, their beliefs about what this means varied in association with their experience and the type of school in which they taught. Having professional contact and the type of school that a teacher works in was associated with differences in teachers' beliefs about where children with special educational needs and autism should be educated. Those who had professional contact with children with autism were less likely to believe that children with SEN (in general) learn most effectively in a special school, rather than a mainstream/regular school (M=2.99, SD =1.0), in comparison to teachers without such contact (M=2.56, SD=1.3; t=2.29, df =131, p=0.027). Those who had this contact were also less likely to believe (M=2.58, SD=1.13,) that children with autism should be taught in special schools, than the no contact group (M=2.13, SD =1.0, t=2.24, df=125, p=0.017).

Although most respondents (89.9%) agreed or strongly agreed that 'All Children have the right to education with their peers', their responses to questions regarding school placement varied in relation to their type of school. Teachers who worked in regular schools agreed more strongly (M=2.05, SD=.89) than teachers in inclusive schools (M=2.65, SD=1.18, t=-2.59, df =81, p=0.011) that children with autism should be educated in special schools and also that all children with SEN require education in special schools (Regular school teachers M=2.4, SD=1.1, Inclusive school teachers M=3.13, SD = 1.1, t=12.77, df=81, p=0.007).

Descriptive Analysis

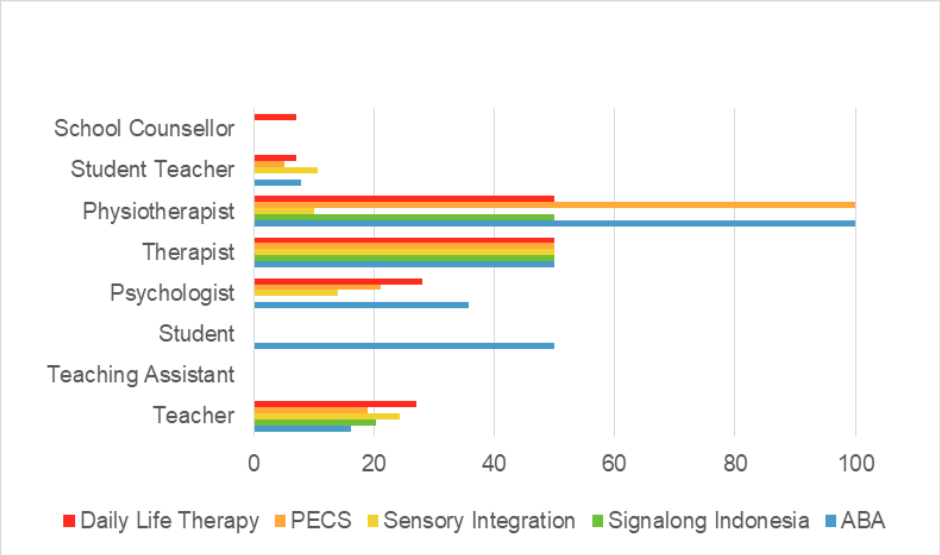
The majority of participants had not heard of *any* of the identified approaches. However, some respondents used, or been trained to use, particular approaches and this is illustrated in Figure 1.

Figure 1. Percentage of Participants that have been trained in or had used Specific Interventions



The five most commonly used approaches were ABA Lovaas (Ariyanto et al., 2017), Signalong Indonesia (Budiyanto, Sheehy, Kaye, & Rofiah, 2017), Sensory Integration (Ottenbacher, 1982), PECS (Bondy, 2012) and Daily Life Therapy (Larkin & Gurry, 1998). Examining which groups of respondents had been trained in these "top five" approaches indicated that the trained minority tended to be trained in more than one approach. This is illustrated in Figure 2.

Figure 2. The Percentage of Participant Groups Trained In the Five Most Popular Interventions



Beliefs and Taboo. Nearly one in five (17%) of the participants reported that they had met teachers who believed that autism was caused by breaking a taboo, and 12% had met teachers who believed that autism was caused as the result of karma.

Stigmatisation. In relation to beliefs about stigmatisation, 30% of participants agreed (SA and A) that parents were stigmatised by their community if their child has autism, and 37.5% neither agreed nor disagreed with this. Almost a quarter (24%) of participants agreed with the statement that teachers of children with autism are stigmatised by their community, and 32.6% neither agreed nor or disagreed. There was a positive correlation between a belief that parents were stigmatised and that teachers of children with autism were stigmatized (rho =0.49, $p<0.01$, two tailed). There was also a negative correlation between a belief that parents are stigmatized and a belief that All children have a right to education with their peers (rho=-0.237, $p<0.001$).

Response Analysis

The questionnaire data were reviewed for conducting a principal component analysis (PCA). Although the sample of 136 was less than in other studies (MacCallum,Widaman, Zhang & Hong, 1999), it yielded a Kaiser–Meyer–Olkin

(sampling adequacy) score of 0.782 indicating that distinctive reliable factors could be extracted (Beavers et al., 2013). This was supported by Bartlett's test of sphericity (p <0 .001). A PCA with Varimax rotation was carried out and informed by scree analysis, values below 0.35 were omitted. Five components were extracted see Table 2.

Table 2. Principle Component Analysis (n=136)

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Sensory Integration	.849				
TEACCH	.820				
PECS	.807				
Floor Time	.806				
Daily Life Therapy	.805				
Biomedical interventions	.802				
Son-Rise	.790				
Religious Interventions	.775				
Javanese Folk Healing	.772				
Signalong Indonesia	.770				
Gentle Teaching	.737				
ABA Lovaas	.725				
Chinese Alternative Medicine	.708				
Happy/Senang teaching		.873			
Regular Teachers/Special Training		.817			
Happy/Suka teaching		.803			
All Children Right to Edn with Peers		.567			
Meaningful learning is social		.521			
Income Access suitable education			.850		
Income-Access Diagnosis			.815		
Autism & Special Talents/Abilities			.588		
Autism-Mainstream Support			.492		
Autism- Specialist Settings				.756	
SEN requires Special School				.723	
Autism Taught in Special School			.389	.566	
Autism-Clear Answers				.374	
Edn Potential Fixed at Birth					
Average stays Average					
Parents-Stigmatised by Autism					.668
Teachers-Stigmatised by Autism					.598
Access Bahasa Indonesia materials			.377		-.399

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

PC1- Knowledge of interventions. As expected from the descriptive statistics, participants' responses to the 'interventions and approaches' questions indicated that the minority who have experience of one approach are likely to have

experience of others too. Conversely those who lack knowledge of one are likely to lack knowledge of other approaches.

PC2. Social Constructivist, joyful teaching for all. This component indicates the associations between social constructivist epistemological beliefs, the importance of happiness (of different types) in pedagogy and a belief in all children having a right to education with their peers.

PC3. Mainstream education and special abilities. A belief that children with autism can do well in mainstream schools is associated with beliefs that autistic children have special talents and abilities, and that access to diagnosis and education depends on parental income. There is a positive association between these beliefs and access to information about autism written in Bahasa Indonesian.

PC4. Special schools for SEN pupils with direct transmission teaching. The beliefs that children with SEN and also those autism should attend special schools was associated with a belief in a 'clear answers' teaching approach. This item is taken as an indicator of direct traditional teaching methods (as opposed to social constructivist or problem solving approaches beliefs) (OECD, 2009).

PC5. Access to information and the stigmatization of Autism. There was a negative relationship between access to information in Bahasa Indonesia and beliefs in the stigmatisation of teachers and parents of children with autism. Respondents with less access to Bahasa Indonesia information were more likely to report that autism was stigmatizing.

Open Comments. Additional comments were provided by 77 respondents. All of these indicated a desire for training in relation to autism and all felt that this would be helpful in their roles as educators. Teachers (42%) explicitly asked for training opportunities where they could practice and develop their skills. Although most teachers were not aware of autism related approaches, several requested training in specific approaches or areas, possibly prompted by the questionnaire itself. For example behaviour modification training (11%), creating autism friendly environments (6%) and language and communication approaches, such as Signalong Indonesia (8%). Where training was requested, the preferred nature of this training was seminars and lesson study workshops (26%). Lesson Study is an established approach in Japan (Fernandez, 2002) and is well designed for continuing professional development (Hiebert, Morris, & Glass, 2003). This approach has an explicit practical pedagogic focus and has been used successfully in Indonesia (Subadi, Khotimah, & Sutarni, 2013). Only one response requested training in addressing stigmatisation

Discussion

The participants' responses indicated that children with autism were being educated in a variety of schools in Indonesia, including within regular schools, and

this reflects comparative research in other countries (Sheehy, Rix, Fletcher-Campbell, Crisp, & Harper, 2013). This is the first Indonesian research to show that many regular school teachers are teaching children with autism, and challenges the suggestion that this group of children are necessarily unlikely to access even special education within Indonesia (Tucker, Finkelhor, Turner, & Shattuck, 2013). However, because autism is such a diverse phenomenon further research is required to understand the individual factors associated with these responses and the nature of the provision that is being made for them. For example, in other countries children with autism who are intellectually able are included in mainstream, whilst others may be excluded, or included because of parental income (Alqahtani, 2012).

The results support Tucker's (2013) conclusion that most teachers have not received specific training in how to educate autistic students. Most teachers were unfamiliar with any of the teaching approaches that were considered, in a situation where many are teaching children with autism. This underlines the need for further research to explore, and assess the efficacy of, the pedagogical practices that are developing for children with autism within the Indonesian educational system outside of the "named approaches". Meta-analysis of research into teaching children with ASD indicates that such research has been culturally and ethnically narrow in its focus (West, et al., 2016). Researching Indonesian practice would help address this narrow focus and contribute to developing more sustainable impacts on classroom practice. The potential introduction of 'named' training approaches should acknowledge the nature of Indonesian pedagogical and cultural practices in relation to autism. Importing non-Indonesian approaches into inclusive classrooms requires critical reflection and evaluation, as the positive results obtained in Western research with narrow groups of participants may not translate well to underrepresented cultural groups (West, et al., 2016). Another issue concerns the drive towards developing inclusive education within Indonesia and how any existing approaches might be used within this context. The use of extra-national experts and their approaches does not have a successful record of sustaining effective teacher development within Indonesia (Allen, Hyde, Whannel, & O'Neill, 2017). It was notable one of the 'top five' approaches was Signalong Indonesia, a keyword signing approach recently developed for inclusive Indonesian classrooms (Budiyanto et al., 2017), that supports full class communication through Bahasa Indonesia (Indonesian Language). It contrasts with the other approaches whose origins are within special education from other countries. Evaluations of teaching approaches should consider the degree to which they support or transform the practices within Indonesian inclusive classrooms. This would help acknowledge the importance of developing pedagogies within their cultural context (Tabulawa, 2013). This might include reference to the relationship between notions of happiness and pedagogy (Budiyanto et al., 2017), which is indicated in the findings.

The teachers' responses clearly indicated that they would like training in teaching children with autism, specifically training which is practical in nature and allows skill development explicitly relevant to their classroom practice. One approach mentioned by teachers as being useful in this respect was Lesson Study.

Originating in the nineteenth century (Saito, 2012), the Lesson Study approach is well established in Japan, where it is known as Jugyokenkyu. Jugyo translates a lesson and kenkyu as study (Fernandez, 2002). It is a systematic inquiry into teaching practice through the detailed examination of lessons [kenkyujugyo "research lessons"], which offers teachers the opportunity for collaborative learning through reflection on real life class situations. Its use within Western cultures has been problematized (Fernandez, 2002; Saito, 2012; Subadi, Khotimah, & Sutarni, 2013). But it would appear to fit well with Indonesian teacher culture (Nai, Degeng, Setyosari, & Widiati, 2016) and its use within some sections of the Indonesian education system have had positive results as part of school-university partnerships (Hendayana, 2014), for example in relation to improving the quality of maths teaching and pupils outcomes (Nai, Degeng, Setyosari, & Widiati, 2016). It has been particularly useful where innovation in practice is needed (Inprasitha, Isoda, Wang-Iverson, & Yeap, 2015). Outcomes-based evaluations of Lesson Study have concluded that it can have a significant impact on the development of teachers classroom practice (Guerrero, 2014; Ó Murchú, 2011). Due to its nature it can minimize the risk of pedagogical colonization (Allen et al., 2017) and has been used successfully for teacher development in relation to teaching children with autism (Norwich & Jones, 2014). These factors suggests that the Inclusive Classrooms Project should explore the Lesson Study approach in relation to meeting teachers explicit requests for practical real life skills development and as a vehicle for developing classrooms practices for children with autism within Indonesia.

The issue of stigmatization has been raised in relation to cultural beliefs about autism (Riany, Cuskelly, & Meredith, 2016) and intellectual disabilities (Sheehy, Budiyanto, Kaye, & Rofiah, 2017), and the current research supports and extends these findings. Respondents indicated that not only are children with autism stigmatized but shows, for the first time, that teachers (and parents) of autistic children can also be stigmatized. The issue of access to appropriate information about autism has been raised as a factor for influencing parent child relationships (Tehee, Honan, & Hevey, 2009) and the current research shows that access to information in Bahasa Indonesia is associated with beliefs about stigmatization in teachers. Access to Bahas Indonesia information is also associated with belief about the school placement of children with autism (Component 3).

Cultural beliefs, such as taboo and karma, are important influences on how parents perceive autism (Riany, Cuskelly, & Meredith, 2016), and the current research is first to identify that these issues also apply to how some teachers think about autism. Understanding the interplay between cultural beliefs, stigmatization, autism and beliefs about school placement merits further research. It would be useful to conduct in-depth teacher interviews to gain deeper insights and qualitatively delineate the nature of the cultural beliefs in the context of education. Given the exceptionally diverse nature of Indonesian society, it is likely to be useful to explore specific geographical areas, where beliefs may vary in relation to regional religious and cultural influences.

A caveat to these findings is that the participants were attending a conference on special educational needs. They therefore had a particular interest in this area

and so their responses may not reflect those of a wider sample of teachers, who might be disinterested in this area or were already confident practitioners.

Conclusion

A purpose of the research was to inform future directions of the Inclusive Indonesian Classrooms project and, more broadly, contribute to the training of teachers of children with autism in Indonesia. This research has produced original findings about the education of children with autism within Indonesia. The data indicate that this group of children are being educated within regular, inclusive and special settings. This is occurring against backdrop in which most teachers are unfamiliar with the teaching approaches most often used with autistic children in other countries, and where taboo and stigma play a role in some stigmatizing beliefs about autism, which includes the stigmatization of teachers. The notion of using a Lesson Study approach for teacher development was suggested. There is evidence that this approach transfers well to the Indonesian context and can support the development of new culturally sensitive classroom practices. A recommendation from this research is that the Inclusive Classrooms project should pilot and evaluate this means of teacher development. Furthermore, in relation to stigmatization, there is evidence of the importance of teachers having access to information in Bahasa Indonesian. The research has elicited some specific areas for future research, which improve understanding of the interplay between Indonesian culture, pedagogies, and the education of children with autism.

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Appendix

Appendix 1. Questionnaire Items (Without Response Scales or Open Response Spaces)

1. What is your current occupation?
2 If you work in a school, what type of school is it?
3 Meaningful learning takes place when individuals are engaged in social activities
4. Children learn best through collaborative activities
5. Children with autism learn most effectively in a specialist setting, alongside others who have similar needs
6. Autistic children learn best from tasks with clear ,correct answers
7. Students' educational potential is fixed at birth
8. Students who begin school with 'average' ability remain 'average' throughout school
9. Children with special educational needs learn most effectively in a special school not in a regular school
10. Regular teachers need special training to teach children with autism
11. All children have a right to education with their peers
12. To learn effectively children must be happy- Senang
13. To learn effectively children must be happy- Suka
14 I have met teachers who believe that autism is caused by

- Breaking a taboo
- Karma

15

- Parents are stigmatised by their community if they had a child with autism
- Teachers are stigmatised by their community if they teach children with autism

16 Many different teaching and medical approaches have been used for children with autism. Please tick below to indicate if you have been trained in, used without training, heard of or not heard of these approaches

- ABA or Lovaas Therapy
- Biomedical Intervention
- Chinese alternative medicines
- Javanese folk healing
- Religious intervention
    - TEACCH
    - Floor time
    - Son-Rise
    - PECS (Picture Exchange Communication System)
    - Signalong Indonesia
    - Sensory Integration
    - Gentle teaching

- Daily Life Therapy

Q17 I have had contact with children with autism

- as part of my professional work
- outside of my professional work

Q18 I am able to access the materials that I need about autism and teaching children with autism written in Bahasa Indonesia

Q19 Do you feel you have the skills to teach a child with autism? (Yes/No)

Q20 Children with autism..

- Can learn well in mainstream classes, with appropriate support
- should be taught in special schools
- have special talents and abilities

Q21 Currently, a family's income determines

- their child's access to diagnosis
- their autistic child's access to a suitable education

Q22 What sort of training or information would be most helpful to you to support children with autism in your school?

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Is Mathematical Logic Really Necessary in Teaching Mathematical Proofs?

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As it is already observed by mathematicians and educators, there is a discrepancy between the formal techniques of mathematical logic and the informal techniques of mathematics in regards to proof. We examine some of the reasons behind this discrepancy and to what degree it affects doing, teaching and learning mathematics in college. We also present some college students' opinions about proofs, and we briefly observe the situation in Greek and Greek-Cypriot high schools in which mathematical logic is part of the curriculum. Finally, we argue that even though mathematical logic is central in mathematics, its formal methods are not really necessary in doing and teaching mathematical proofs and the role of those formalities has been, in general, overestimated by some educators.

Keywords: formal, logic, proof, student, teacher.

Introduction

In several colleges, some parts of mathematical logic (i.e. sets, propositional logic, and predicate logic) are usually taught in the early chapters of a discrete mathematics class, in order to prepare the students for the important chapter on proofs and proving techniques. Yet, most likely, students have already been exposed to proofs before the above-mentioned course in other mathematics courses or even in high school. Mathematical logic is to sharpen the logical and analytical skills of a student as these are necessary for the understanding and learning of mathematical proofs. Mathematical logic though is characterized by its symbolic presentation and formal rules. Mathematics, on the other hand, combines mathematical symbolism and natural language and its methods are rigorous yet less formal.

Historically, logic is associated with Aristotle and his work the *Organon* in which he introduced terms like "propositions" and "syllogisms", the basics on categorical and hypothetical syllogism, and modal and inductive logic. It is also associated with the Stoics and their propositional logic, and their work on implication. Syllogistic logic and propositional logic led later to the development of predicate logic (or first order logic, i.e. the foundational logic for mathematics) by Frege and Hilbert in the 19th century. As Ferreiros said:

> "First-order logic emerged as an analysis of the most fundamental basis for the notion of mathematical proof. To put it otherwise, it emerged as the logic that is necessary

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> and sufficient for codifying mathematical proofs, axiomatizing mathematical theories, and studying their metatheory." (Ferreiros, 2001, p. 479)

Predicate logic is also the foundation of modern mathematical logic. The latter is a subfield of mathematics that includes fields such as set theory, model theory and proof theory, and its primary interests are the foundations of mathematics and theoretical computer science.

The interest in the foundations began in the 19th century with the development of axiomatic frameworks for geometry and arithmetic by Hilbert and Peano respectively. That led in the early 20th century to three main philosophies regarding the foundations of mathematics, namely Logicism, Formalism and Intuitionism, none of which adequately accounts for those foundations. Gödel pointed out the issues of consistency and completeness related to provability in general formal systems. Nevertheless, most mathematics can be formalized in terms of sets, and set theory serves nowadays as its foundation. In real mathematical practice though rarely one adheres to set-theoretical foundations to validate or refute mathematical questions. Each mathematical field has its own tools and methods and with general logical framework the predicate logic explores its own questions, proves its own theorems, and establishes connections between fields. Even though mathematical logic is central in mathematical practice, its strict symbolism and formal rules are rarely used in mathematics, whose mathematical symbolism, language and methods are rigorous yet less formal.

In the subsequent sections, we will look at the differences between the formal techniques of mathematical logic and the informal techniques of mathematics in regards to proof. We will examine how it affects doing, teaching and learning mathematics, give some examples, and present some college students' opinions about proofs. We will also see what/when logic is taught in Greek and Greek-Cypriot high schools as it is part of the school curriculum.

What is Mathematical Proof?

Even though there is no complete agreement among mathematicians on what constitutes a mathematical proof, it is accepted by most that proof is a central activity in mathematics. A proof is basically a line of reasoning that mathematicians would employ in order to convince someone about the truth of a mathematical statement. A mathematical proof is usually written in an algerbraic-symbolic form, mixed with natural language, and it has among others the following basic objectives: (a) verification, (b) discovery, (c) explanation, (d) communication, (e) challenge, (f) systematization. This is what is usually characterized as "*informal proof*" and what most practicing mathematicians usually do and understand as proof. As Hersh says:

> "Practical mathematical proof is what we do to make each other believe our theorems." (Hersh, 1997, p. 49)

A proof also could be re-phrased, proved differently, refined, completed, etc. All the above play a crucial role in the mathematical progress.

Students often learn about the different types of proof techniques, such as direct proof, proof by cases, proof by contradiction, etc., which are based on some basic logical rules of inference such as modus ponens, modus tollens, resolution, etc., and their extensions in predicate logic.

Example: If n is an odd integer, then n^2 is odd.

Proof: Let n be an odd integer. Then, there exists an integer k such that $n = 2k + 1$.
Squaring both sides of the equation, we have that:
$n^2 = (2k + 1)^2 = 4k^2 + 4k + 1 = 2(2k^2 + 2k) + 1 = 2\lambda + 1$, where $\lambda = 2k^2 + 2k$.
Hence, by the definition of odd, we have that n^2 is odd.

The above proof is a typical (informal) mathematical proof, and is based on the modus ponens. That is, on the logical schema:

$\forall x\,[O(x) \rightarrow O(x^2)]$
$O(n)$
……
$\therefore\ O(n^2)$

where $O(x)$ = "x is odd" and $x \in Z$.

What about "*formal proofs*"? A formal proof (derivation) is a sequence of steps where from a given set of sentences (premises) one derives another sentence (conclusion) using the logical rules of inference. A formal proof has more of a syntactic nature, than semantic and employs deductive reasoning rather than other forms of reasoning. It is highly rigorous, recalls all relevant axioms and definitions, uses and manipulates logical symbols, and emphasizes the verification aspect of a proof, and not so the explanatory aspect. So, the previous example would be written formally as follows:

Example: If n is an odd integer, then n^2 is odd.

Proof:

1.	$O(x)$	premise
2.	$\exists z\,(x = 2z + 1)$	1, definition of odd
3.	$x = 2m + 1$	2, existential instantiation
4.	$x^2 = 2(2k^2 + 2k) + 1$	3, algebra
5.	$x^2 = 2z + 1$	4, existential generalization
6.	$O(x^2)$	5, definition of odd
7.	$O(x) \rightarrow O(x^2)$	1-6, modus ponens
8.	$\forall x\,[O(x) \rightarrow O(x^2)]$	7, universal generalization

Notice that some mathematicians claim that a proper proof is actually the formal proof, or at least that an informal proof is acceptable if a formal proof could in principle be constructed. As Rota says:

> "A proof of a mathematical theorem is a sequence of steps which leads to the desired conclusion. The rules to be followed by such sequence of steps were made explicit when logic was formalized early in this century, and they have not changed since." (Rota, 1997, p. 183)

Finally, formal proofs are usually checked and constructed using computers and they are quite long (see Figure 1) and time consuming. For example, the proof of Kepler's Conjecture by Hales in 2006was more than 250 pages long (Hales & Ferguson, 2006), and it took a group of 22 people more than 10 years to formalize the proof (Hales et al., 2017).

Figure 1. The proof of the irrationality of $\sqrt{2}$ in proof assistant Isabelle

Main theorem

The square root of any prime number (including 2) is irrational.

```
theorem sqrt-prime-irrational: p ∈ prime ⟹ sqrt (real p) ∉ ℚ
proof
  assume p-prime: p ∈ prime
  then have p: 1 < p by (simp add: prime-def)
  assume sqrt (real p) ∈ ℚ
  then obtain m n where
     n: n ≠ 0 and sqrt-rat: |sqrt (real p)| = real m / real n
  and gcd: gcd (m, n) = 1 ..
have eq: m² = p * n²
proof -
  from n and sqrt-rat have real m = |sqrt (real p)| * real n by simp
  then have real (m²) = (sqrt (real p))² * real (n²)
    by (auto simp add: power2-eq-square)
  also have (sqrt (real p))² = real p by simp
  also have ... * real (n²) = real (p * n²) by simp
  finally show ?thesis ..
qed
have p dvd m ∧ p dvd n
proof
  from eq have p dvd m² ..
  with p-prime show p dvd m by (rule prime-dvd-power-two)
  then obtain k where m = p * k ..
  with eq have p * n² = p² * k² by (auto simp add: power2-eq-square mult-ac)
  with p have n² = p * k² by (simp add: power2-eq-square)
  then have p dvd n² ..
  with p-prime show p dvd n by (rule prime-dvd-power-two)
qed
then have p dvd gcd (m, n) ..
with gcd have p dvd 1 by simp

corollary sqrt (real (2::nat)) ∉ ℚ
  by (rule sqrt-prime-irrational) (rule two-is-prime)
```

Source: Wenzel & Paulson, 2006, p. 42-43.

Issues with Formal Logic

Comparing the two proofs in the example above, one can see some quantitative and qualitative differences. First, the second proof is a bit longer and it can get much longer when the theorems get more interesting. Then, one notices that the second proof is not very explanatory or communicative. It is intended to deductively verify the theorem, and it reminds of a computer program. As a matter of fact, if the above proof were computer-performed, it would also get even longer as one would be required to input also all necessary definitions, axioms and calculations, in order to arrive to the conclusion. Finally, the second proof is not the way that mathematicians do and publish proofs in their field, neither is the way they teach their students in mathematics classes.

But why is that? There are several reasons. We outline some below.

Epistemic Reasons

On the practical level, making proofs unnecessarily longer, less readable, and harder to communicate, does not benefit the students or the teachers in terms of knowledge. Since proofs are central to the development and transfer of mathematical knowledge, they should be in a format that most understand, so students or teachers can communicate it to others and motivate discussions that could lead to further discoveries. On the theoretical level, could all mathematical statements be formalized and proved? Godel's Incompleteness Theorems impose some serious restrictions on provability within a formal system that is large enough to handle basic mathematics. Marfori argues quite convincingly that formal understanding of proof "yields an implausible account of mathematical knowledge, and falls short of explaining the success of mathematical practice" (Marfori, 2010, p. 261). She raises two important objections: one referring to the circularity of the notion of rigorous proof and one doubting formalism's explanatory power with respect to ordinary mathematical practice.

Not Just Deduction

Even though deductive inference is central in proofs and in mathematics in general, it is not the only type of inference in mathematical practice. Peirce considers three kinds of logical inference, namely deductive, inductive and abductive, which he sees as important stages in mathematical inquiry (Bellucci & Pietarinen, 2018). Certainly, deduction allows one to move from some hypotheses to a conclusion, but hypotheses and conjectures must be formed in the first place. That can be done by induction and abduction by looking at some specific examples first, draw analogies, and then generalizing. Deduction, in mathematical inquiry, usually comes at the last stage as a way to verify certain observations. Polya (1954; 1973) and Lakatos (1976) explain the process of mathematical discovery very clearly. For example, Polya lays down some steps for general problem solving that include: understanding the problem, experimenting,

conjecturing, generalizing, trying to prove and proving or disproving. The steps before the proving step are what one would call the inductive/abductive stage[2].

Intuition also Necessary

Clearly, logic is necessary for doing mathematics. But is it sufficient? As Hadamard said:

> "[…] strictly speaking, there is hardly any completely logical discovery. Some intervention of intuition issuing from the unconscious is necessary at least to initiate the logical work." (Hadamard, 1954, p. 112)

In a completed proof, formal or informal, one rarely sees all the mathematical activity that preceded the proof. That activity might have included scattered thoughts, incomplete notes, calculations, drawing diagrams, experimenting, moments of inspiration, several failures, frustration, etc. All these activities are sometimes part of the mathematical process, yet they are not part of the logical process. And they are not characterized by the deductive nature that usually characterizes a proof. A proof seems to comprise all the above in an end result argument, and comes after the discovery. And, in general, logic seems to merely follow intuition.

Not all are Computer Scientists

In a computer science class, logic is covered not only to serve as a problem solving tool, but also, as Hein says:

> "[…] for its use in formal specification of programs, formal verification of programs, and for its growing use in many areas such as databases, artificial intelligence, robotics, automatic reasoning systems, and logic programming languages." (Hein, 2010, p. vi)

Formal proofs are also covered, usually after informal proofs have been covered. As important as Hein's topics may be, they are not the primary interests in a mathematics course, even in a discrete mathematics course which is prerequisite to computer science. In mathematics course the emphasis falls on informal proofs, their structure and the information they convey, the relation of the proved theorems to other theorems, examples, historicals, and, of course, some applications to other sciences.

[2]Polya also explains the difference between induction and mathematical induction (a deductive process) and gives a nice example applying all the previously mentioned steps (1973, p.114-121). In particularly, he proves the theorem "The Sum of the First *n* Cubes is a Square", showing all the previous steps and activity that led one to the theorem, doing calculations, using visuals, forming conjectures, etc.

Some Objections

With the advancement of computers, programming and computer algebra systems in particular, some argue for the use of formal techniques in mathematics for philosophical but also pragmatic reasons. For instance:

> "-To establish or refute a thesis about the nature of mathematics or related questions in philosophy.
> -To improve the actual precision, explicitness, and reliability of mathematics." (Harrison, 2008, p. 1395)

Regarding the first point, Harrison justifies the formalization of mathematical proofs by appealing to the foundations of Mathematics. As he says:

> "[…] the defining characteristic of mathematics is that it is a deductive discipline. Reasoning proceeds from axioms (or postulates), which are either accepted as evidently true or merely adopted as hypotheses, and reaches conclusions via chains of incontrovertible logical deductions." (Harrison, 2008, p. 1395)

As Harrison continues, in the past, informal methods caused ambiguities and errors[3], and informal proofs bearing the burden of being explanatory lost rigor and precision. Hence, it is only natural to utilize the deductive nature of mathematics and strive for formalizing proofs and presenting them in a "high-level" conceptual way. This way, there are no issues of uncertainty or errors and one is sure of what has been proved from given assumptions. A computer program could take over this process, as it has already done for several theorems, and help tremendously and change the mathematical practice.

The only problem though is that Harrison puts mathematics on narrow foundations. Mathematics is more than just deduction of statements and proof is just one of the stages in the mathematical activity[4], as Lakatos (1976) and Polya (1954; 1973) nicely documented in their classic works. Also, as many mathematicians explain, axiomatization usually comes at the end of the process and not the beginning (Cellucci, 2002).

Now, regarding Harrison's second point, he points to the fact that mathematics is applied in society so issues of precision and reliability in mathematics, as well as computer science and engineering, are important as they can have pragmatic consequences. Hence, it is paramount that not only mathematics should be checked for correctness by computer programs, but also computer programs should be checked for correctness as well. Harrison recognizes the difficulties in this, since computer proof-correctness programs could be usually long and tedious with few people understanding them, yet, as he claims, that should not be considered as an argument against formal verification of a proof. To

[3]Harrison mentions D'Alambert's false proof of the Fundamental Theorem of Algebra in 1746. One could add Gauss' incomplete first proof in 1799 of the same theorem.

[4]A nice presentation of that using the quaternions as an example is in Papastavrides (1983), where the author shows the interplay of observation, experimentation, imagination and proof in a famous mathematical discovery.

the contrary, he suggests that we should invest and improve even more our computer methods.

But, the question of reliability still stands, and if the point is to be sure of a proof by mechanically checking it, then how can one be sure of the program that checks the proof? Considering that computer checking is long and tedious, certainly longer and harder than human checking, does not that defeat the purpose of demanding efficiency? For example, the proof of Fermat's Last Theorem is quite long and few mathematicians have read and understood it. Some could have doubts regarding its validity, correctness, etc., and that is quite understandable. But, writing a complex program ten times longer, that also few people understand it, in order to check the theorem, is it something reasonable to pursue? Why not giving incentives, as one could suggest, to say ten mathematicians in humanly verifying the proof?

The first automated theorem prover, known as the "Logic Theory Machine" was developed in the 60's by Newell and Simon (1956). It mimicked the logical skills of a human, but it dealt only with theorem proving from propositional logic[5]. The first computer proof assistant in mathematics was used in the 70's by Appel and Haken in the proof of The Four-Color Theorem (improved in the 90's by Robertson et al.), in which a large number of case checking and calculations was done by the computer. That caused a big controversy on what ultimately a proof is and whether computer proofs could be considered proofs. In 2005, Gonthier (2005; 2008) gave a formal proof of the Four-Color Theorem using the proof assistant Coq which automates the whole proof process itself. Also, in the 90's, Hales gave a large computer assisted proof of Kepler's Conjecture which, as we mentioned in previously, he proved in 2006 and formally proved in 2017 using the proof assistant HOL Light. About one hundred other important theorems were formalized[6], including some in the undergraduate level (e.g. the Fundamental Theorem of Calculus). So, advocates of formal proof would say that this practice is doable and useful, and a natural part of the scientific development and progress.

But, even though there is no doubt that these are important logical and technological achievements, all the above formalized proofs still remain philosophically controversial. First, one must distinguish between proof verification and proof discovering. Proof assistants are formal syntactical systems based on deductive logic that can be used to check whether a set of premises imply a conclusion, independently of content and semantics. Discovery requires more than logical deduction, for example observation, intuition, etc., and not all proofs are deductive. Finally, even though important theorems have been formalized, it does

[5]For example, it proved several theorems from Russell's and Whitehead's Principia Mathematica. Another interesting program was Lenat's program AM ("A Mathematician") in the 70's, which exhibited also some creative behavior as it was based on some general heuristics. Nevertheless, AM has its drawbacks too. See more here: https://bit.ly/2Z4fSEa.

[6]Such as, the First Incompleteness Theorem (by Shankar, Boyer-Moore system, 1986), the Fundamental Theorem of Calculus (by Harrison, HOL Light system, 1996), the Fundamental Theorem of Algebra (by Milewski, Mizar system, 2000), the Prime Number Theorem (by Avigad et al., Isabelle system, 2004), the Four Color Theorem (by Gonthier, Coq system, 2005), the Kepler's Conjecture (by Hales, HOL Light system, 2017), etc. (Wiedijk, 2008; see also: https://bit.ly/2MV0O9D).

not mean that all theorems can be formalized (Harrison, 2008, p. 1403-1404). There are also technical issues which are not in accordance with mathematical practice. For example, HOL Light and Mizar systems define $\frac{1}{0} = 0$, even though it is actually undefined, because the systems' functions cannot account for "undefined" and the algorithms require an input in order to run (Wiedijk, 2008).

In Class

The emphasis given on the foundations of mathematics in the first half of the 20th century, and the rise of programming, automation and computers in the 60's, that we described in the previous section, naturally affected education as well. As Hana says:

> "The hallmark of the mathematics curriculum adopted in the sixties was an emphasis on formal proof. Among the manifestations of this emphasis were an axiomatic presentation of elementary algebra and increased classroom attention to the precise formulation of mathematical notions and to the structure of a deductive system." (Hana, 1989, p. 20)

This "new mathematics", as it was usually called, was criticized in the 80's by Hana (1983, 1989) Kitcher (1984), Davies (1986), Tymoczko (1986) and others, and educators we forced to modify the curriculum de-emphasizing formalities, rigor and proof, and emphasizing more examples and applications. It has been debatable since then, if that was the right approach that should had been followed, as complains were raised later regarding the coherence of the material taught and the impact of reducing rigor and proof had on the critical skills of the students. But, what did some empirical studies show? Deer (1969) found that teaching an explicit unit on logic did not have any effect in improving students' abilities to prove geometric theorems. Cheng at al. (1986) found that college students who took introductory logic had no advantage over students who did not take the course in solving the Wason's Selection Task, yet using concrete examples does improve students' reasoning abilities. On the other hand, Platt (1967) and Mueller (1975) showed that teaching logic was beneficial to geometry students, especially if the logic was covered in context. Also, Durand-Guerrier and Arsac (2009), Durand-Guerrier et al. (2012) and Epp (2003; 2009) claimed that logic is a useful tool in mathematics, yet it should be presented "in a manner that continually links it to language and to both real-world and mathematical subject matter" (Epp, 2003, p. 895). Similarly, as Durand-Guerrier et al. said, "teaching logic as an isolated subject generally appears to be inefficient in developing reasoning abilities" (Durand-Guerrier et al., 2012, p. 375).Hence, it seems to me that a safe conclusion to be drawn from the above is that logic is useful but it should be done in context.

In my experience from teaching discrete mathematics, I certainly see the relevance of logic to mathematics, but I also noticed the following:

a. Students have conceptual difficulties with the semantics (e.g. "$\wedge$", "$\rightarrow$", etc.) and the scope of propositional logic. For example, some of the connectives seem ambiguous or non-sensical. In particular, students struggle with the conditional "$\rightarrow$" and its truth values[7]. The fact that propositions p and q could be false yet the proposition $p \rightarrow q$ is true is not something that the students can empirically easily accept, especially when p and q are unrelated. And justifiably so. Neither this logical fact is something that the students use much in proper proofs. Because in mathematical proofs, we are mainly interested in starting from true premises and arriving at true conclusions and in starting from true premises to false conclusions when disproving. The case when the premises are false is usually deemed irrelevant.
b. The formal aspects of logic are quickly dropped, as they are unnecessary. Students have already difficulties with informal proofs, so adding extra formalities and complicating things even further seems anti-pedagogical. Even the few logical rules the students need for mathematical proofs could be summarized and included in the beginning of the proof section, without much harm done. Much of the previous material, especially on propositional logic, could easily be omitted. One could simply start with minimal logical rules and the basic axioms of the subject being studied[8]. See (Suppes, 1965).

Regarding (b), and motivated by some of the research done already, we also asked some of our students' input on the matter in a short survey. In two questionnaires given to 45 students in two discrete mathematics courses, we asked their opinions on some issues related to formal and informal proof and recorded their responses (see Appendix). In particularly, in Questionnaire A, students were given a formal and an informal proof of the same theorem and were asked which they find more rigorous, which they understand better, which is more explanatory, etc. In Questionnaire B, students were given a pictorial proof (without words) and an informal proof of the same theorem and were asked the same questions as above. Their responses are summarized in the Table 1.

Table 1. Responses to the Questionnaires

Questionnaire A		**Question 1**	**Question 2**	**Question 3**	**Question 4**
Proof 1		88.8%	91.1%	84.4%	22.3%
Proof 2		11.2%	8.8%	15.6%	77.7%
Questionnaire B		**Question 1**	**Question 2**	**Question 3**	**Question 4**
Proof 1		4.5%	6.7%	22.3%	26.7%
Proof 2		95.5%	93.3%	77.7%	73.3%

[7]More on the "paradoxes" of the conditional see Lewis (1917); Farrell (1979); Mansur (2005). Also, for students' difficulties with the conditional see Hoyles and Küchemann (2002); Romano and Strachota (2016).

[8]An important issue could be raised here, on whether content matters in teaching proofs. According to some educators it does. See Savic (2017).

Surely, one could observe the following:

1. Indeed, the sample was small (45 students) and the conclusions are simply suggestive, not conclusive. Nevertheless, as the survey was more qualitative than quantitative, and many students explained the reasons for their responses, we do get a clear glimpse of their opinions on proof.
2. In Question A.1, contrary to what one would expect, most students found Proof A.1(informal proof)more rigorous than Proof A.2 (formal proof). Considering their comments, an explanation for that could be that the students relate rigor with understanding. Something that they do not really understand clearly, it is perhaps pointless to deem it as rigorous. Similarly, in Question B.1, students stated that Proof B.2 (informal proof) is more rigorous than Proof B.1 (pictorial proof) due to the use of algebra.
3. In Question A.2, overwhelmingly most students found Proof A.1 (informal proof) more explanatory than Proof A.2 (formal proof). As many students explained the first proof is easier to follow and understand and shorter. Similarly, in Question B.2, students stated that Proof B.2 (informal proof) is more explanatory than Proof B.1 (pictorial proof) due to the use of algebra, words, etc. On the contrary, in an older questionnaire (see Questionnaire C, in Appendix), more students found the Euler Diagram more explanatory than the formal proof in understanding the validity of an argument.
4. In Question A.3, most students found Proof A.1 (informal proof) more prompting to explore further similar questions than Proof A.2 (formal proof). Although not many clear reasons were given for that, some students stated that the informal proof was easier and the same reasoning could be used to deal with other similar questions and build similar examples. One student said that algebra related to everything in mathematics, so it was a better tool to explore things further than diagrams. Similarly, in Question B.3, students stated that Proof B.2 (informal proof) was more prompting than Proof B.1 (pictorial proof).
5. In Question A.4, most students found Proof A.2 (formal proof) more appropriate for computers than Proof A.1 (informal proof). As some students said, that is because the formal proof follows order and is written line by line, which is perhaps their way to say that it is more deductive. On the other hand, in Question B.4, students said that Proof B.2 (informal proof) is more appropriate for computers than Proof B.1 (pictorial proof) because computers do not understand images and prefer symbols.
6. Overall, students found the informal proof more rigorous than both the formal and pictorial proofs. More rigorous than the formal proof because it did not contain unnecessary information and formalism, and more rigorous than the pictorial proof because it contained essential information, notation and explanations. It seems that the students followed the middle ground. Also, the students found the informal proof more explanatory than both the formal and pictorial proofs. Apparently, even a minimal use of natural language plays an important role in understanding, as only symbols or figures are not enough. Finally, most students believe that more precision, order and symbolism relates more to computers.

Logic in Greek and Cypriot High Schools

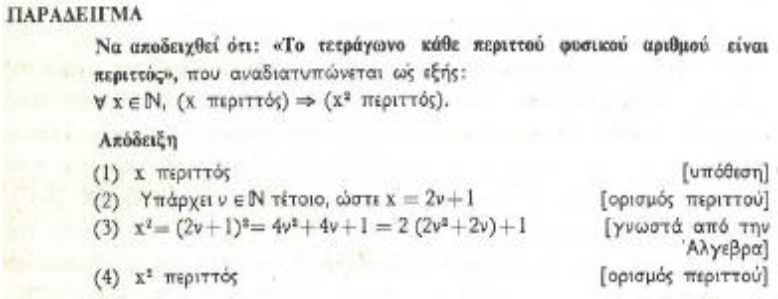
What is the status of logic in Greek and Cypriot high schools? In Greece, at the end of the 19th century logic was taught in high schools but it had a more theoretical than analytical nature. It emphasized syllogistic logic and lacked symbolism. Even though it mentioned proofs (deductive and inductive proofs) the examples did not usually come from mathematics, with some exceptions from geometry. Also, logic was not part of introductory sections in mathematics books.

Figure 2. A Logic Book for Greek High Schools from 1906

Source: Skliros, 1906.

In the70-80's logic, as we cover it today, was incorporated in some mathematics books usually as an introductory chapter. It covered the basics on propositional and predicate logic, and the examples were mathematical. Proofs were covered and, interestingly, they were something between the formal and informal proof that we described (see Figure 3).

Figure 3. The Proof of the Same Example we Mentioned Previously



ΠΑΡΑΔΕΙΓΜΑ

Να αποδειχθεί ότι: «Το τετράγωνο κάθε περιττού φυσικού αριθμού είναι περιττός», που αναδιατυπώνεται ως εξής:

$\forall x \in \mathbb{N}$, (x περιττός) $\Rightarrow$ (x^2 περιττός).

Απόδειξη

(1) x περιττός	[υπόθεση]
(2) Υπάρχει $\nu \in \mathbb{N}$ τέτοιο, ώστε $x = 2\nu+1$	[ορισμός περιττού]
(3) $x^2 = (2\nu+1)^2 = 4\nu^2+4\nu+1 = 2(2\nu^2+2\nu)+1$	[γνωστά από την Άλγεβρα]
(4) x^2 περιττός	[ορισμός περιττού]

Source: Varouchakis et al., 1983, p.26.

A proper logic text is a book by Kyriakopoulos (1977), in which propositional and predicate logic is covered inall detail and all important connections to mathematics are mentioned. As a matter of fact, in regards to our discussion on formal-informal proof here, Kyriakopoulos interestingly stated[9] that:

> "[…] in mathematics, the proofs of propositions are not presented in the form of formal proofs, that we saw in the previous chapters. Formal proofs are long and therefore, not only cumbersome, but also time consuming. Due to that and because in mathematics logic is considered known, in the proofs of propositions of a

[9]My translation.

> mathematical theory, not all steps are mentioned and the logic rules are not particularly emphasized." (Kyriakopoulos, 1977, p. 160-170)

Nowadays, elements of logic are included in an introductory chapter of Andreadakis et al. (1998) in the 4th year in high school, but are usually omitted. Some methods of proof (direct and by contradiction) are discussed in chapter two of the same book. In the 5th year of high school, several proofs in number theory (including induction) are covered in chapter four of Adamopoulos et al. (1998). Finally, in the 6th year of high school, there is an optional logic course (Anapolitanos et al., 1999) which is not mathematically oriented and is never taught.

In Cyprus, a relatively extensive chapter on logic and proofs was introduced in high schools in 2017. That was a significant change as since the 80'slogic was not covered and few proofs were done in high school[10]. The chapter is covered in the 5th year of high school, in chapter one of Demetriou et al. [2017]. As it is stated in the book[11]:

> "The book has a two-fold role to fulfill: to introduce the student in the syllogistic that is expressed by the unsurpassable logico-inductive system of mathematics and also to respond to the modern mathematical demands. All the material included in the present book, […] is intended on the one hand to help the students understand the mathematical logic and thought and on the other to contribute to the mathematical education of the country." (Demetriou et al., 2017)

I am not sure if the book achieves its objectives and it certainly has its problems,[12] yet it looks like a step in the right direction for Cyprus' educational state of affairs. It contains informal proofs, it does not distract student with unnecessary logical formalities, and it is kept relevant to mathematics.

It seems that Greek and Greek-Cypriot curriculums are diverging regarding logic, but converging regarding proof. I am not aware of what, if any, studies were considered in order to decrease or increase logic in the two curriculums and what objectives are expected to be achieved[13]. Nevertheless, it does not seem to me that

[10]Before the 80's, Cyprus was basically following the Greek educational system and books. Some Greek books are still used in Cyprus even today.

[11]My translation.

[12]For a book with twelve authors much more was expected. It was criticized unofficially on the Facebook group *ΜαθηματικοίΚύπρου* (*Cyprus Mathematicians*) in 2017. The text feels that it was written in a rush and contains some mistakes. For example, negations of quantified propositions are poorly discussed (p.23), there are omissions whether a number is "real" or "integer" in examples (p.11), numerical errors (p.13), etc. There seems also to be a confusion regarding "propositions" and "propositional functions" (p.24). Kyriakopoulos also points out to a misunderstanding of "necessary" and "sufficient" conditions in an example that uses Bernoulli's Inequality (p.51). All the above and some suggestions/corrections are included in an unpublished article by Theodoros Tsaggaris, posted in the group above in 2017. I am not aware if some or any material in the book were improved later.

[13]As we have seen, studies in general are not in agreement on the relevance of logic in mathematical understanding and performance. The Greek studies on this topic are scarce, and I found only few related articles on proof mainly from the Proceedings of the 4th and 6th Pan-Hellenic Conferences of the Union of Researchers in Mathematics Education (Εν.Ε.Δι.Μ). The most relevant article I found

either curriculum is aware of the conceptual gaps between propositional logic and mathematics. Truth tables and syllogisms are not very useful when we prove things in mathematics. Propositional logic is at best a "warm up" to the predicate logic, which is indeed the appropriate logic for mathematics, and several things from the former could be omitted. From predicate logic some things are important and could perhaps be covered before the section on mathematical proofs. The two curriculums though do keep the formalities to a minimum, since increasing the formalities in proofs, as we argued, does not improve proof doing or understanding and it might even hinder mathematical experience and process.

Conclusion

The basics of predicate logic form the foundation of mathematics and proof lies at the heart of mathematical practice. Yet, even though mathematical logic is required in mathematics, its strict symbolism and formal rules are rarely used in mathematics whose mathematical symbolism, language and methods are rigorous yet less formal. The difference of these two approaches (formal-informal) affects doing, teaching and learning mathematics. Some argue that a proof is complete only if it is done formally. Others insist that requiring formalities actually inhibits mathematical activity and progress. Formal proof checking and verifying is tediously long and is nowadays done by powerful computer programs with minimal errors, but we are still far from computerized proof making. Some also doubt whether formalizing mathematics serves any mathematical or pedagogical purpose.

In class experience from teaching Discrete Mathematics showed that some of the sections and some of the formalities of logic, taught usually in the beginning of the course, are not necessary for the subsequent important chapters on proof. Also, empirical evidence from students' responses revealed that to a large extend students relate rigor with understanding and not formalism. They related formalism more to computer reasoning and natural language to human reasoning. As students also found informal proofs more rigorous than pictorial proofs, because it contained essential information, notation and explanations, it seems that the students followed a middle ground indicating that even a minimal use of natural language plays an important role in understanding as only symbols or figures are not enough.

Finally, what is the situation regarding logic in Greek and Greek-Cypriot high schools? We traced historically the curriculum changes regarding logic from the 1900's and we saw that today Greek and Greek-Cypriot curriculums are diverging on the teaching of logic, but converging regarding proof. Neither curriculum seems to be aware of the conceptual gaps between logic and mathematics, and it is

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was an unpublished and undated article entitled "The Role of Logic in Teaching, Learning and Analyzing Proof" by Morou A. and Kalospyros N., which most likely was written after 2008. The authors examine "whether students in upper secondary schools can improve their reasoning and proof abilities by taking an introductory course in logic" (Morou and Kalospyros), and they conclude that they could. I contacted the authors for more details, but I never received a response.

unclear whether they achieve their objectives. Nevertheless, both include logic as a chapter in a mathematics course, keeping it relevant to mathematics and keeping formalities to a minimum.

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Appendix

Questionnaire A

Consider the theorem:

The sum of any two odd integers is even.

Look at the two proofs below and answer the following questions:

***Proof*1**:
Let x and y be arbitrary odd integers.
Then, there exist integers m and n such that $x = 2m + 1$ and $y = 2n + 1$.
Adding x and y we get $x + y = (2m + 1) + (2n + 1) = 2m + 2n + 2 = 2(m+n + 1) = 2k$, where $k = m+n + 1$.
Therefore, $x + y = 2k$, which means that $x + y$ is even.

***Proof*2**:

1.	odd(x)	premise
2.	odd(y)	premise
3.	$\exists z\,(x = 2z + 1)$	1, definition of odd
4.	$\exists z\,(y = 2z + 1)$	2, definition of odd
5.	$x = 2m + 1$	3, existential instantiation
6.	$y = 2n + 1$	4, existential instantiation
7.	$x + y = 2(m + n + 1)$	5, 6, algebra
8.	$\exists z\,(x + y = 2z)$	7, existential generalization
9.	even($x + y$)	8, definition of even
10.	odd(x) $\wedge$ odd(y) $\rightarrow$ even($x + y$)	1-9, conditional proof
11.	$\forall x$ [odd(x) $\wedge$ odd(y) $\rightarrow$ even($x + y$)]	10, universal generalization
12.	$\forall y$ [odd(x) $\wedge$ odd(y) $\rightarrow$ even($x + y$)]	11, universal generalization

1. Which proof from the ones above establishes the result more rigorously? Why?

2. Which proof from the ones above you understand better and you would communicate to others? Why?

3. Which proof from the ones above prompts you to explore similar questions? Why?

4. Which proof from the ones above is more appropriate for computers? Why?

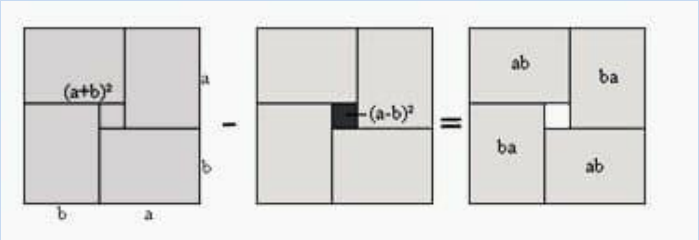
Questionnaire B

Consider the theorem:

$$(a+b)^2 - (a - b)^2 = 4ab \text{ , } a, b \text{ reals.}$$

Look at the two proofs below and answer the following questions:

***Proof* 1**[14][13]:



***Proof*2**:
Using the perfect square identity twice, the left-hand side is:

$(a + b)^2 - (a - b)^2 = a^2+2ab + b^2 - (a^2 - 2ab + b^2)$

$= a^2+2ab + b^2 - a^2+2ab - b^2$

$= 4ab$

which equals the right-hand side.

1. Which proof from the ones above establishes the result more rigorously? Why?

2. Which proof from the ones above you understand better and you would communicate to others? Why?

3. Which proof from the ones above prompts you to explore similar questions? Why?

4. Which proof from the ones above is more appropriate for computers? Why?

[14] Picture taken from https://bit.ly/2Z4N6Dx.

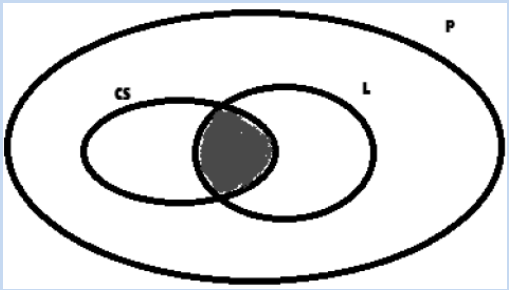
Questionnaire C

Consider the following valid argument:

All computer science majors are people
Some computer science majors are logical thinkers
Therefore, some people are logical thinkers

Which of the two reasonings below helps you more to understand the argument's validity? Why?

***Reasoning* 1**:

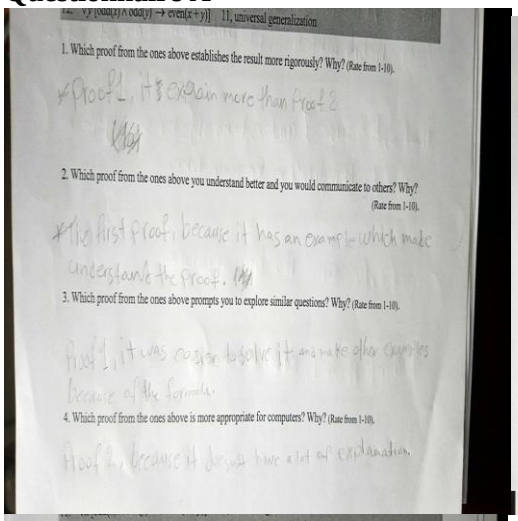


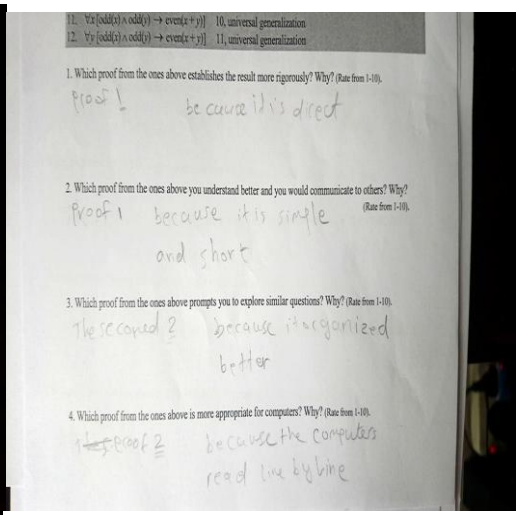
***Reasoning*2**:

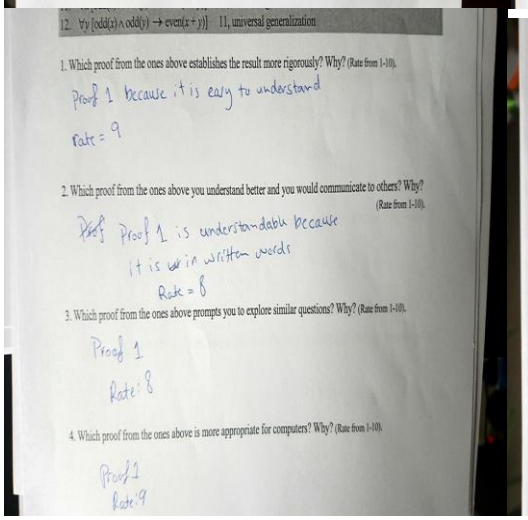
1.	$\forall x\,[C(x) \rightarrow P(x)]$	premise
2.	$\exists x\,[C(x) \wedge L(x)]$	premise
3.	$C(c) \wedge L(c)$	2, existential instantiation
4.	$C(c) \rightarrow P(c)$	1, universal instantiation
5.	$C(c)$	3, simplification
6.	$P(c)$	4, 5, modus ponens
7.	$L(c)$	3, simplification
8.	$P(c) \wedge L(c)$	6, 7, conjunction
9.	$\exists x\,[P(x) \wedge L(x)]$	8, existential generalization

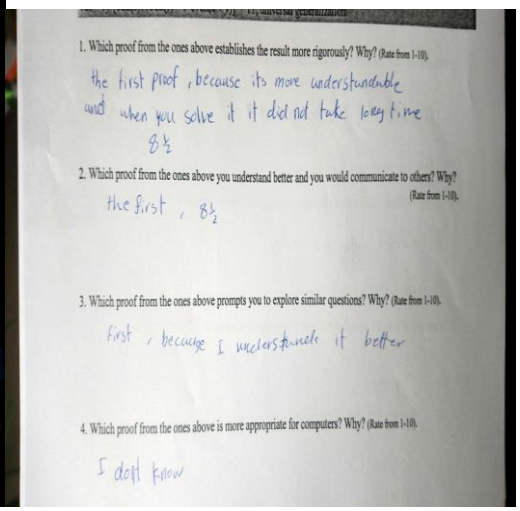
Some Students' Responses

Questionnaire A

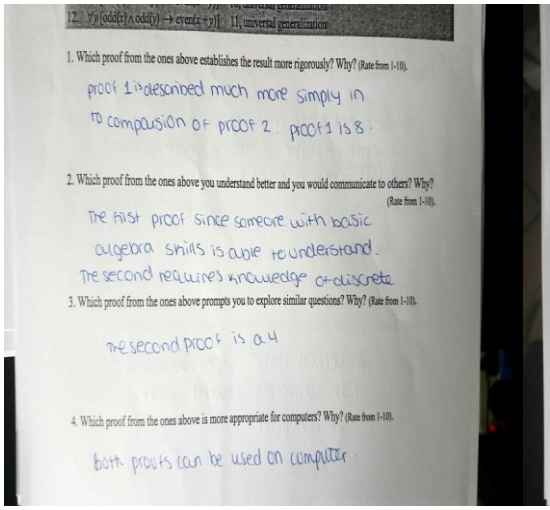


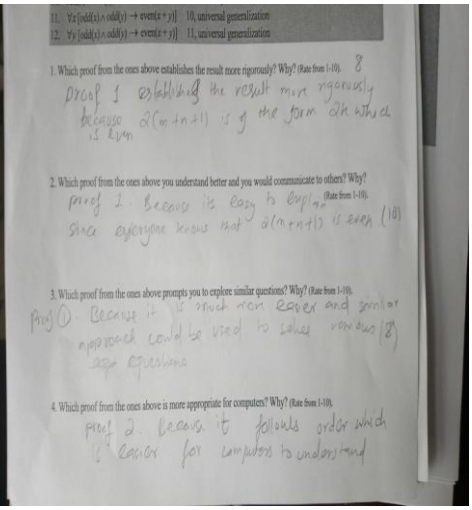


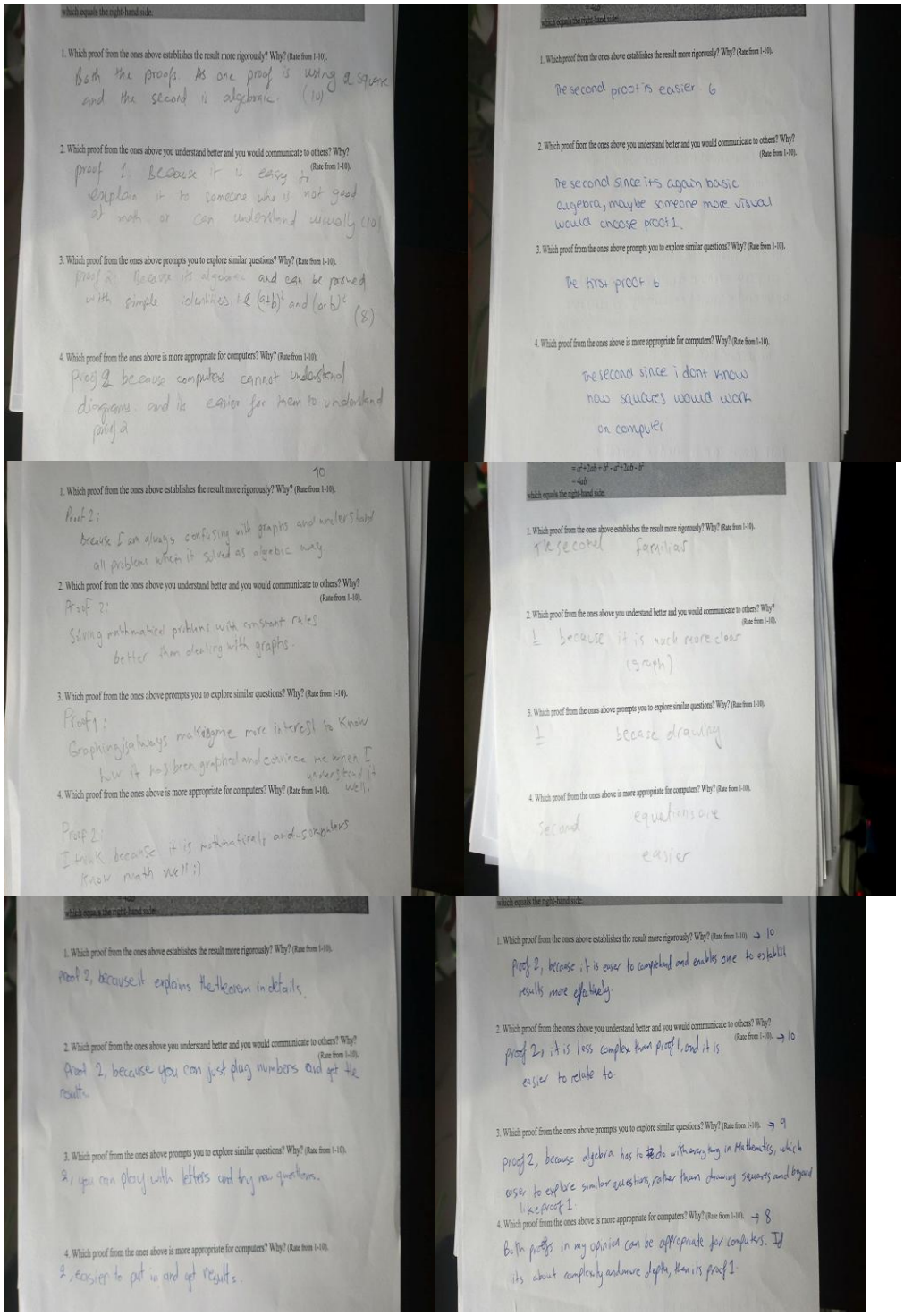




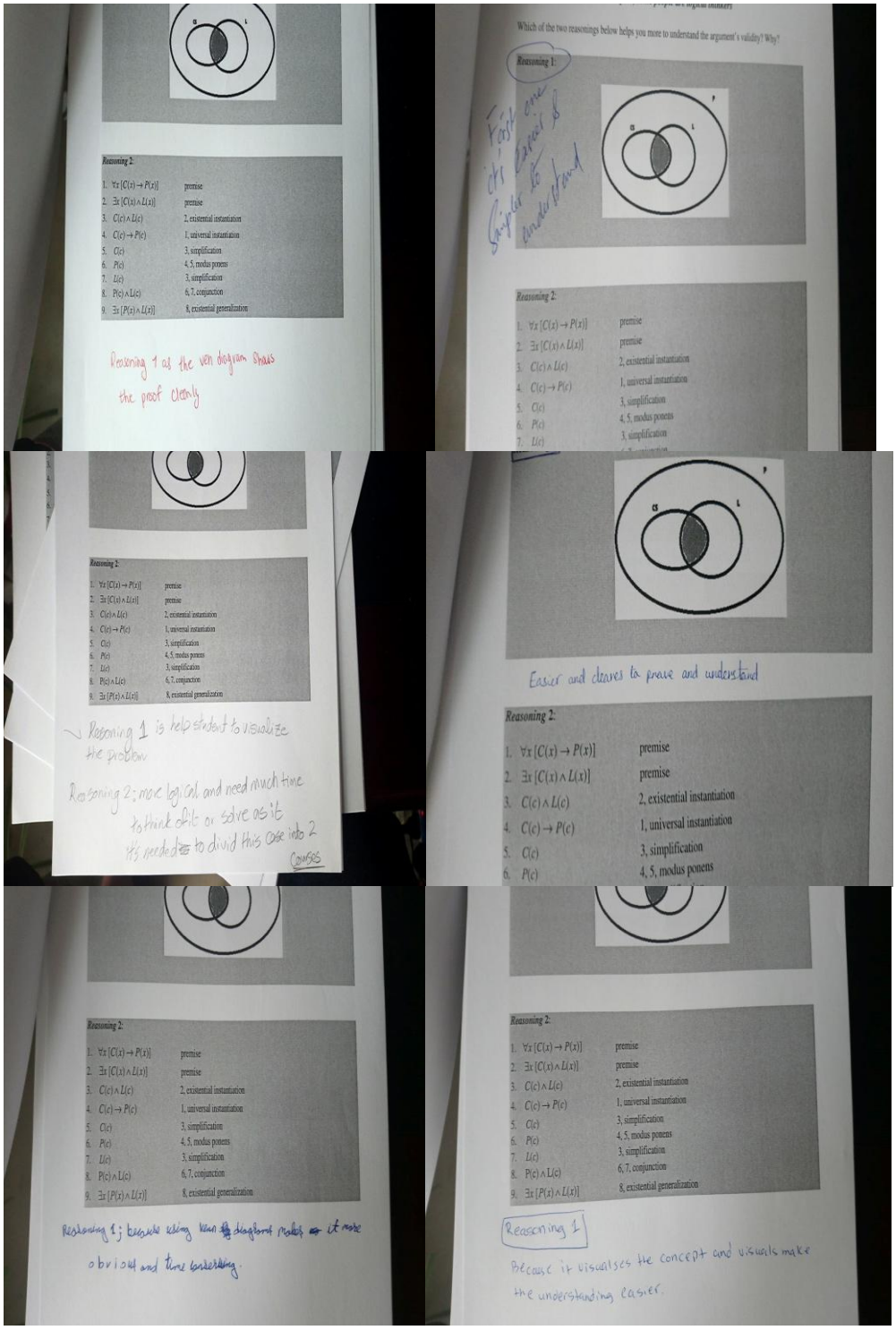
Questionnaire B







Questionnaire C



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Analysing the Correlation between English Proficiency and Academic Performance among Thai University Students

By Matthew Rudd[*] & Lawrence Honkiss[†]

The primary objective of this research paper is to examine the relationship between students' English language proficiency skills and academic performance across unrelated subjects from a sample population totalling 2,026 students at a private university in the surrounding areas of Bangkok. Participants in this research study comprised first, second and third year students from four separate faculties: engineering, business administration, I.T and veterinary science. This study collated English language assessment results and grade point average from all participants to analyse the correlation between the two performance-related variables via t-test significance testing (0.05) and Pearson's correlation coefficient analysis. On the grounds of Spearman's "g" factor theory of intelligence, this paper worked on the theory that higher English performance outcomes would naturally translate into higher GPA attainments. The t-test results derived from quantitative data indicated that the means of the two sets of performance-related variables were significantly different ($p < 0.05$). However, the correlation coefficient analysis revealed a highly positive relationship between English language proficiency and GPA attainments ($r = 0.653$), leading to the unequivocal observation that higher English proficiency levels were associated with higher standards of GPA across all measures; (1) year group, (2) gender, (3) faculty, and (4) the entire sample population.

Keywords: academic performance, attainment, language, proficiency.

Introduction

A number of accounts have long since claimed a positive relationship between foreign language proficiency skills, and the potential to transfer higher degrees of performance into unrelated academic disciplines. Wiley (1985), found that college students who had studied a foreign language at school, namely Latin, German, French or Spanish, could be expected to perform at higher levels in college than their counterparts who were on the same par academically, but had not previously studied a foreign language.

Results from a separate research study proposed the positive cognitive benefits of bilingualism on academic performance in a general sense. Kessler & Quinn (1980) at Georgetown University discovered a positive correlation between bilingualism and problem-solving skills in science. They discerned the cognitive

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advantage of bilingualism afforded to young learners in formulating scientific hypotheses and discovering solutions to problems. The findings discovered that bilingual children constantly *outperformed* monolingual children in the *quality of hypotheses generated* and in the complexity of written language. One reasoned argument cited from the same source (1980) was that children who participate in bilingual programmes develop two linguistic perspectives and can make *the positive interactions of cognitive functioning and language development more fully operative*. However, it must be pointed out that bilingual learners naturally acquire two languages, (effectively two L1s), and the innate mental processes of such acquisition are very disparate from those involved in the academic pursuit of a second language.

Although these findings certainly are of pedagogical interest, one particular distinction must be made. The study relating to the impact of bilingualism on academic performance answers an entirely different category of research questions to those set out in this paper, given that the learning process for second language acquisition (L2) is entirely separate to that of first language acquisition (L1). No matter the complexity of the L1, infants master their native language(s) effortlessly, and in some multi-heritage family backgrounds, they are able to become simultaneously bilingual or even trilingual. Contrarily, this paper aims to examine the correlation between English language proficiency as a separate academic subject, and students' GPA from an unrelated domain. Very little detailed research coverage appears to be freely available on this matter.

General Intelligence Factor

Charles Spearman (1904) coined the term '*g*' factor, which worked on the precept that all tasks on intelligence tests, whether mathematical or verbal, where influenced by this underlying *g* factor. Spearman developed a factor analysis based on a statistical procedure of his own formulation, which tests the correlation between intelligence-associated variables that are cognitively unrelated. Namely, these measures include directions, mathematics, verbal skills, as well as the ability to perceive pitch and colours. The upshot of Spearman's data was that individuals scoring well in one given domain had also performed higher in other unrelated tasks (Myers, 2009), which *points to the existence of a global factor that permeates all aspects of cognition* (Gottfredson, 1998). According to behavioural geneticist Robert Plomin, aside from indicating one's general level of intelligence, the *g* factor can also help to shape anticipations of individuals' selection processes and future vocational considerations; *"g* is one of the most reliable and valid measures in the behavioural domain … and it predicts important social outcomes such as educational and occupational levels far better than any other trait" (Pederson, Plomin, & McClearn, 1994).

It has been proposed that the *g* factor accounts for 40 to 50% of the between-individual performance differences on cognitive tests and composite (IQ) scores (Kamphaus et al., 2005). In addition to which, Jensen (1998) maintained that the predictive validity of *g is most conspicuous in the domain of scholastic*

performance, largely because *g* is closely associated with the ability to learn novel material as well as understand concepts and meanings.

Howard Gardner's Multiple Intelligence (M.I) theory includes a degree of overlap with Spearman's *g* philosophy. In addition to measuring cognitive abilities such as musical-rhythmic (composing music), visual-spatial (spatial judgment), verbal-linguistic (words and languages), logical-mathematical (critical thinking), bodily-kinaesthetic (training responses – sports, dancing), Gardner (1999) considered certain personality characteristics as forms of intelligence such as interpersonal skills (communication and empathising) and intrapersonal skills (self-reflection). Linguistic and logical-mathematical abilities are widely accepted as forms of intelligence, and that artistic and characteristic skills have been encompassed into the MI theory as they constitute a broader scope of inherent mental abilities, which Gardner believed were overlooked in a one-dimensional testing format, such as an IQ value; "I balk at the unwarranted assumption that certain human abilities can be arbitrarily singled out as intelligence while others cannot" (Gardner, 1998).

Furthermore, Gardner (1995) maintains that any given domain (physics, chess, and music) can be realised through the use of several intelligences. Gardner also suggested that educators contemplate differentiating the teaching of content to address individuals' constitutional variations of intelligence, and to proportionately allocate more time to fewer key subjects, as opposed to broad superficial coverage taught in homogenised fashion; "… any uniform educational approach is likely to serve only a minority of children" (Gardner, 1995).

The Transfer of Cognitive Skills

A number of academics have proposed possible similarities between the nature of learning a foreign language and unrelated subjects. MacGregor & Price (1999) suggested metalinguistic awareness enables the language user to *reflect on the structural and functional features of text as an object, to make choices about how to communicate information, and to manipulate perceived units of language.… Analysing structure, making choices about representation, and manipulating expressions are (also) intrinsic to mathematics*, (p. 452). Adams (2003) recognises that mathematics is not by definition classified as a language, but advances that the mental processes involved in learning mathematics and English as a foreign language are not dissimilar.

Wakefield (2000) considered mathematics to be a language given the use of abstraction to communicate (through verbal or written symbols representing ideas or images), encoding and decoding for purposes of communication, and that students learn to adhere to rules which are uniform and consistent. In addition, syntax arrangements are crucial to the representation of meaning in both subjects given that the order of symbols affects meaning. Languages often offer a range of grammatical variations to convey the same meaning, whereas mathematics may offer a variety of strategies to work out the solutions for one particular equation. As a result of this mutual cognitive influence, foreign language learning has been claimed to result in increased academic flair "in a broader sense", and research has

proven that children who are exposed to a foreign language at a young age achieve higher levels of cognitive development (Bialystok & Hakuta, 1994; Fuchsen, 1989), because language learners show greater cognitive flexibility, superior problem solving capabilities, and, higher order thinking skills (Hakuta, 1984).

Strong evidence also indicates that time spent on foreign language study helps to reinforce the core subject areas of reading, English language literacy, social studies and maths. Foreign language learners consistently outperform control groups in core subject areas on standardised tests, often in significant fashion (Armstrong & Rogers, 1997; Saunders, 1998; Masciantonio, 1977; Rafferty, 1986). In this research paper, all data are generated from under graduates of science-related fields which usually entail a large degree of numeracy demands and mathematical logic.

Literature Review

More recently, a number of EFL related research studies have come to light, providing greater detail on research methods and data analysis. Three studies below drawn from three separate continents have been identified for discussion.

Nigeria: the first paper for discussion appeared in the Journal of Scientific Research (2009, p.490-495) which measured the English proficiency of 200 Nigerian secondary school students (109 males and 91 females) from eight random schools in Oyo and Osun states (four schools in each state). The study reviewed the correlation between students' English language skills, and how proficiency in English can predict overall academic performance. Students underwent an English Language Proficiency Test (ELPT- a standardised TOEFL paper), to gauge students listening, reading comprehension, grammar and writing skills. The students were also interviewed to test for speaking proficiency, taking account of pronunciation, style, vocabulary, grammar, syntax, fluency and accuracy. After which, the scores of the participants were collected across three core subjects: English, mathematics and biology. Subsequently, correlation coefficient analysis was used to determine the impact of English language proficiency on students' overall academic achievement.

Following the ELPT test results, the students' level of English was categorised as follows: only 4% of the sampled students failed the proficiency in English test (less than 40%), 21.5%: ordinary pass (40-49%), 43%: lower credit (50-59%), 26%: upper credit (60-69%), 6.5%: distinction (70-79%). The mean value of the students ELPT score was 58.2%, which showed that the students' proficiency of English was classified as a high average standard.

Findings revealed that there was a significant positive relationship between proficiency in English language and academic performance ($r = 0.499$; $p < .05$). The positive relationship implied that the greater the students' English language proficiency, the higher the level of overall academic performance. The dependent variable revealed that the coefficient of determination, *(adjusted R2 = 0.408, which gives the proportion of variance to be 40.8%),* meant that 40.8% of the total

changes in students' academic performance were determined by the level of the students' proficiency in English language. The effect is therefore shown to be significant ($F\ 1,198) = 18.0$; $p < .05$), and the study concluded that 41% of the variation in students' performance is determined by students' proficiency in English.

Bangladesh: a similar study published in the ABAC Journal 5 years later (May - Aug 2014, vol. 4, p. 64-70) revealed a parallel trend. The study focused on testing students' proficiency in English across several faculties at United National University in Dakar, Bangladesh. The study sampled 90 students aged 19-24, (50 male and 40 female), from the school of Business, Science and Engineering. Students sat a 90 minute writing examination to test for grammar, reading comprehension, vocabulary and structural use of paragraphs. The assessment process also comprised a listening test and individual presentations, followed by spontaneous questioning. The results collated were compared with the students current CGPA (Cumulative Grade Point Average). Upon statistical analysis, the correlation coefficient (0.05 significance) of the two sets of results was calculated at 0.58, suggesting that the more proficient the students' English, the higher their level of academic achievement.

Australia: the third EFL related study discussed in this section was published in the International Educational Journal (Vol 3, No4, 2002) and was conducted at the University of Southern Australia. The research focused on exchange students' English proficiency (measured by IELTS scores) and the respective impact on academic performance. Students are admitted on study placements based on their current GPA at their university of origin and IELTS English proficiency levels. In the year 2000, the university tested the relationship between international students' IELTS scores and their corresponding GPA. The secondary purpose behind the study was to evaluate the potential changes in student population as a consequence of increasing the IELTS entry cut-off scores from 6.0 up to 6.5.

The research project encompassed a population of 101 foreign students, with approximately half of the students being male and half female. Furthermore, half of the sample population were postgraduate, and half undergraduate with a mean age of 25.6 years. Students were predominantly from Asian countries, chiefly China, Malaysia and Indonesia. The mean GPA was 4.87 and the IELTS entrance scores mostly ranged between 6.0 and 7.0. The outcome revealed that, for the 46 undergraduate students, a regression coefficient of +0.39 for IELTS suggested a (mild) positive relationship between IELTS and GPA; thus for every one unit increase in IELTS score, the mean GPA rose by 0.39. Though relatively weak, a correlation nonetheless was recognised. The relationship proved to be more salient among the 55 postgraduate students, which was implied by the regression coefficient of +0.79.

However, the enhancements in GPA seem inconsequential when considering the impact on student enrolments. The increment of 0.5 points in IELTS entrance scored would lead to a colossal 50% reduction in undergraduate admissions, and an insufferably heavier loss in post-graduate student enrolments (-67%). Moreover,

the study also contemplated the effects of raising the IELTS entry cut-off score to 7.0 for post-graduate courses. The desirable increase in GPA (8.87%) would be offset by the unacceptable decline in student population (78%), posing long-term financial infeasibility. In spite of the potential decrease in student population, the calculations maintain that raising the standards of students' IELTS admittance scores (English proficiency) naturally reflects in a higher GPA.

The Significance of this Study

The common implementation variable in each of the reviewed EFL based studies is that the participants were studying academic programmes taught in English which is a forevermore prevalent case worldwide, especially with respect to international subjects such as business administration, media studies, doctorate programmes, engineering and computer science. In their respective forms, all studies concluded by consensus the existence of a positive relationship between students' proficiency in English and their academic performance.

However, none of the papers discussed had sought to identify a correlation between students' English language skills (L2) and their respective academic performance in an unrelated discipline. In the context of this research paper, students study their degree subjects in Thai (typical of most university degree courses in Thailand), and presumably therefore, a weaker level of English proficiency should not have a direct negative impact on performance outcomes in their main field of study. While the completion of English language modules is compulsory, English constitutes a minor subject of most degree programmes in Thailand. Within the parameters of this research, students' performance in both English and their respective academic disciplines (measured in terms of G.P.A) are to be compared to ascertain whether high-performing students in foreign language study are synonymously higher achievers across unrelated subjects.

Research Questions

1. What is the students' level of English proficiency as measured across the following four categories; (1) year group, (2) gender, (3) faculty, and (4) across the entire sample population?
2. What is the students' GPA as measured across the aforementioned categories?
3. What is inferential correlation between the two performance-related variables?

Hypotheses

On account of the '*g*' factor that is alleged to enter into performance across unrelated cognitive tasks, the following two hypotheses have been formulated:

1. Higher levels of English proficiency levels are expected to be associated with a higher standard of GPA.
2. The two performance-related variables are expected to be strongly correlated across all categorical measures.

Methodology

This is a quantitative research study designed to test the relationship between students' ability in foreign language study and overall academic performance (GPA). The sample in this paper encompassed a total of 2,026 students at a university located on the outskirts of Bangkok. The English courses provided by the university are designed to be communicative and do not include essay writing. The focus of the course is to consolidate students' understanding of essential grammar and vocabulary, and to reproduce these forms in communication. Each course is 15 weeks long (one academic term) consisting of 15 English classes which are 2.5 hours in duration. Classes typically range from 20-30 students in size, and most students are categorised as elementary to lower intermediate level learners.

The following data collection tools are to be used to measure English proficiency and overall academic performance in terms of GPA. First of all, English proficiency is scored across two separate criteria which constitute the overall grade; formal examinations and language and communication skills.

1. Formal examinations (55%): consist of two core components. Firstly, the mid-term assessment (15%) is a two and a half hour examination which comprises multiple-choice style questions for grammar, vocabulary and reading comprehension. The final examination (40%) is a significant contribution to the overall grade and also is two and a half hours in duration. The final exam also requires a written output as well as a number of reading comprehension assessments and grammar focused questions. In Thai education, most tests are typically multiple-choice, and the university's formalised assessment structure largely mirrors this typical traditional ideology of testing.
2. Language and Communication (45%): the English Language Centre at the university strives to introduce a range of communicative exercises to activate students' participation in the learning process, and to enrich an *acquisition poor environment* (Ellis, 2009), seeing that students are exposed to very little English outside of the classroom. During communicative activities, students are incited to experiment with independent language use relatively free of corrective feedback in order to build confidence and develop fluency.

Academic Performance is measured by grade point average (GPA) which represents the average value of the accumulated final grades earned in course modules over the time. This formally baselines students' academic performance

across all courses studied in their respective academic disciplines and facilitates contrastive analysis with English language results.

Table 1. Scores Conversion

Percentage	Letter Grade	GPA
90%	A	4
80%	B+	3.5
70%	B	3
60%	C+	2.5
50%	C	2
40%	D+	1.5
30%	D	1

The data were analysed through an independent samples t-test for significance testing (0.05); followed by Pearson's correlation coefficient analysis to calculate the degree of linearity between the two sets of performance variables. Furthermore, statistical comparisons also looked to ascertain the significance of profile-related variables within this parameter; examining performance variations according to (1) year group (2) gender, (3) faculty, and (4) across the entire sample population.

Findings/Results

Prior to answering the research questions set out in this paper, information pertaining to students' demographic profiles across year levels and faculties is required.

Table 2. Profile of the Respondents in Terms of Age, Gender and Course

	Engineers		**Business**		**I.T**		**Vets**			
Age (M)	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*N*	*Total %*
Level 1: 18.6	51	412	90	36	12	57	23	10	691	34.10
Level 2: 19.55	62	405	106	31	18	59	37	13	731	36.10
Level 3: 20.7	59	353	86	29	9	46	15	7	604	29.80
(n)	(172)	(1,170)	(282)	(96)	(39)	(162)	(75)	(30)	(2,026)	
%	8.5	57.8	13.9	4.7	1.92	8.0	3.7	1.5		

Table 2 displays the students' profile details in relation to age, gender and course of study. The mean age of the students was as follows: year level one (18.6 years), year level two (19.55 years), and year level three (20.7 years). The largest sub group in this study were the engineers (n = 1,342) which represented 66.3% of the overall population, and the smallest sub group was that of the veterinary medicine students (n = 105), which comprised merely 5.2% of the overall population**.**

As noted in Table 2, the gender-related demographics vary considerably across faculties. Unmistakably, all faculties are demographically unbalanced; IT and engineering being overwhelmingly masculine, and business and veterinary science more so feminine.

In order to answer the first two research questions set out in this paper, the following data will ascertain students' level of English proficiency, and GPA, as measured across the following four categories; (1) year group, (2) gender, (3) faculty, and (4) across the entire sample population.

The students English proficiency levels were as follows:

Table 3. Mean English Proficiency Scores: Inter-Year Level Comparisons

Year Level	N	M (%)	P	Result
Year One	691	52.77		
			<0.01	Sig p <0.05
Year Two	731	48.96		
Year Two	731	48.96		
			<0.01	Sig p <0.05
Year Three	604	44.81		

Table 3 indicates that students scored higher levels of attainment in their first year of study (M = C grade). Nonetheless, the second year students performed to a significantly lower standard than the first year students, as mirrored in the p value of <0.01. Likewise, identical P value readings, were observed between second and third year students; inferring that the standard of English language attainments declined significantly as a function of year of study (and therefore age).

Table 4. English Proficiency In Relation To Gender

Gender	N	M (%)	SD	P	Result
F	585	56.56	18.94		
				<0.01	Sig p <0.05
M	1439	45.96	16.37		

With respect to gender, Table 1.4 shows that the means of the two sets of English proficiency scores were significantly different, as females ostensibly outperformed their male counterparts, as reflected in the p value (<0.01). Given such a contrast in English language proficiency, it would be of interest to see if female students also outclassed their male peers in non-language subjects, which is reviewed later in this section.

Table 5. English Proficiency According to Faculty

Mean of N	Faculty	M (%)	P	Result
49.02	Engineers	46.61	<0.01	Sig p <0.05
	Business	51.04	0.0424	Sig p <0.05
	I.T	46.86	0.102	Not Sig p <0.05
	Vets	75.94	<0.01	Sig p <0.05

As displayed in Table 5, when individually comparing the means of each faculty with that of the overall sample population, differing levels of attainment were noted across faculties. Only the I.T students' average level of English proficiency was akin to the mean value (p = 0.012). In contrast, business students (p = 0.0424) and particularly veterinary medicine students (p = <0.01) performed to a significantly higher standard than the overall mean. Nonetheless, the engineers' English language performance was significantly below the average benchmark (p = <0.01).

Having analysed the students' English proficiency levels, their respective GPA attainments were determined as follows:

Table 6. Academic Performance According to Year Group

Year Level	**N**	**M (%)**	**P**	**Result**
Year One	691	68.06		
			<0.01	Sig p <0.05
Year Two	731	63.35		
Year Two	731	63.35		
			0.0396	Sig p <0.05
Year Three	604	61.68		

Table 6 establishes that, in concert with English proficiency results, GPA attainments also progressively deteriorated in succession across the three year levels; as mirrored in p = <0.01 between years one and two, and subsequently p = 0.0396 between years two and three. This manifests that academic performance deteriorated significantly as a function of year level.

Table 7. Academic Performance (GPA) According to Gender

Gender	**N**	**M (%)**	**SD**	**P- Value**	**Result**
F	585	69.46	15.49		
				<0.01	Sig p <0.05
M	1439	62.43	14.56		

The data in Table 7 shows that females scored saliently higher GPAs than their male counterparts, as denoted in the p value (<0.01) between the two sets of results. The fact that females scored remarkably higher GPAs, along with significantly higher levels of English language proficiency, begins to contribute to the argument that more proficient English language skills are linked to higher academic achievements. Furthermore, as a result of the females' superior achievements in both English and GPAs, investigative action is encouraged to study the effect of the gender variable in a separate broader context.

Table 8. Academic Performance (GPA) According to Faculty

Mean of N	Faculty	M (%)	P Value	Result
64.57	Engineers	63.15	0.0082	Sig p <0.05
	Business	65.65	0.1930	Not Sig p <0.05
	I.T	63.87	0.522	Not Sig p <.05
	Vets	77.49	<0.01	Sig p <0.05

Table 8 specifies that the veterinary medicine students were the only group to have performed above the average standard of the population (p = <0.01). Contrarily, the average GPA of the engineers was considered to be significantly inferior to the population mean (p = 0.0082) in spite of displaying similar averages (63.15% vis-à-vis 64.57%). Nonetheless, the Business and I.T students' average academic performance was in harmony with the population mean, as reflected in the respective p values of 0.1930 and 0.522.

The following data will be utilised to answer the ultimate research question in this paper pertaining to the relationship between students' English proficiency and GPA attainments.

Table 9. Relationship between English proficiency and Academic performance

Variable	N	M (%)	SD	P	Result	R
English		49.02%	17.91			
	2,026			<0.01	Sig p <0.05	0.653
GPA		64.57%	14.87			

Table 9 reveals that the students' average level of English language proficiency skills (49.02%) is significantly inferior to their overall average level of academic performance (GPA = 64.57%); as highlighted in p = <0.01. Nonetheless, the r value, as calculated from the Pearson's correlation coefficient analysis (r = 0.653) suggests that the two sets of variables are positively correlated, broadly insinuating that higher English proficiency levels are associated with higher GPA achievements.

Table 10. Relationship between English Proficiency and Academic Performance according to faculty

Faculty	Variable	N	M (%)	P	Result	R
	English		46.61			
Engineers		1,342		<0.01	Sig p <0.05	0.636
	GPA		63.15			
	English		51.04			
Business		378		<0.01	Sig p <0.05	0.611
	GPA		65.65			
	English		46.86			
I.T		201		<0.01	Sig p <0.05	0.579
	GPA		63.87			
	English		75.94			
Vets		105		0.4475	Not Sig p <0.05	0.354
	GPA		77.49			

As displayed in Table 10, performances varied considerably across faculties in terms of both English proficiency and GPA attainments. With reference to the Engineers, business students and the I.T group, there was a significant difference between the two sets of performance related variables ($p = <0.01$). Nevertheless, the r value readings infer a positive relationship given that the readings remained constant between $r = 0.636$ and $r = 0.579$ across the three faculties. Inversely, when measuring the relationship between English proficiency and GPA for the veterinary medicine students, $r = 0.354$ insinuated a comparatively weak correlation.

However, the means of the two performance-related variables were not statistically different ($p = 0.4475$), meaning that both performances were of a similar standard. Furthermore, higher English proficiency scores were associated with higher GPAs across every measure, adding further support to the interlinked nature of the two variables. This is reflected in the fact that the faculty demonstrative of the most proficient English skills (vets) simultaneously achieved the highest GPA, and on the contrary, the faculty least proficient in English (engineers) correspondingly attained the lowest GPA attainments.

Discussion

The following three factors (demographics, performance, and, curricular issues) will be discussed in further detail to ascertain the causes of declining academic standards, and, possible solutions to help forestall this problematic trend.

Demographics: while the strength of this experiment was the size and scale of the participants, which was considerably larger than the studies reviewed earlier, the sample did present some limitations. As noted a priori, every faculty was demographically imbalanced and may have led to biased readings, as manifested in the fact that female engineers only accounted for 14% of that individual sub-group. From a wider perspective, 57.8% of the entire population constituted male engineers, which over represents this stratum within the context of this experiment. Further to which, engineers are not commonly typified as avid scholars of English, (as reflected in the results), thus the size of this sub-cluster negatively influenced the mean score for both performance variables relative to the entire sample population. Subsequent research may contemplate faculties comprising similar student numbers and gender-related demographics.

Academic performance: interestingly, students in the foundation year performed at their highest, and standards declined progressively thereafter. This may have pertained to two central factors:

1. Students' gradual disengagement in studying English owing to a growing disinterest, or, the choice to prioritise their main field of study. That said, students' GPA also inexplicably recorded successive deterioration as a function of year group.

2. First year study requirements are considerably more basic and the assessments are simpler to master. Moreover, a large number of students may struggle to increase their commitment to subjects as they become more complex.

Curricular enrichment: the identified need for curricular enrichment is inspired by the observation that students displaying higher levels of English proficiency achieve higher GPAs. Therefore, enhancing curricular design to highlight the development of English language proficiency would presumably lead to broad improvements in GPAs as a result of the cognitive flexibility acquired in the process of achieving higher L2 competence.

The current syllabus focuses on coverage based learning with painstaking attention dedicated to grammar and vocabulary in order to prepare for mid-term and end-term examinations (mostly in the form of multiple-choice format). Nonetheless, students often appear underprepared for speaking tests, fail to understand what is required of them, and, how to perform at satisfactory levels (despite efforts to implement communicative activities throughout the term). In order to increase performance outcomes in this form assessment, students would be urged to experience using the language meaningfully, and to affect this nature of change, this paper proposes the introduction of task-based language teaching (TBLT). This would entail moving the syllabus away from instructing specific grammatical forms towards the processing of semantic and pragmatic meaning (Ellis, 2009, p. 223).

In TBLT students become language "users", as opposed to language "learners" (Ellis 2001), and learning objectives focus on the learning process; aiming to cultivate purposeful and functional language use to express meaning to complete tasks. In addition to which, owing to the mixed ability demographics of the classrooms, group-based activities could help learners reproduce content and elaborate independently, facilitated by teacher guidance. Vygotsky (1978) maintained that interaction with senior peers is an effective means of enhancing the learning process through cooperative learning exercises where less competent learners are able to develop with assistance from more skilful peers. Further to which, Larsson (2001) adds that the importance of social interaction in task-based learning is "positively affected", and that "being an integral part of the group also motivates students to learn in a way that the prospect of a final examination rarely manages to do".

Conclusions

The most inferential generalisation from the results is that the higher the students' English proficiency skills, the higher the respective level of academic achievement; as supported by the positive correlation between the two variables ($r = 0.653$). These findings lend firm support to Spearman's '*g*' factor theory (1904), which summarises positive correlations across a range of cognitive tasks, positing that an individual's performance on one given cognitive task tends to be comparable

to that of other dissimilar tasks. Therefore, if administrators were to prioritise and proactively integrate second language study into academic programmes, the cognitive enhancements derived from such a measure may subsequently enhance academic achievement in broader terms.

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