EDUCATIONAL PLANNING

Vol. 21 No. 2

The Journal of the International Society for Educational Planning
PROMOTING THE STUDY AND PRACTICE OF EDUCATIONAL PLANNING

International Society for Educational Planning

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Educational Planning is the refereed journal of the International Society for Educational Planning (ISEP). *Educational Planning* is published quarterly by ISEP, which maintains editorial offices at 1000 Chastain Road, Kennesaw, GA. 30144

The Journal is assigned ISSN 1537-873X by the National Serials Data Program of the Library of Congress.

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EDUCATIONAL PLANNING
A JOURNAL DEDICATED TO PLANNING, CHANGE, REFORM, AND
THE IMPROVEMENT OF EDUCATION

VOLUME 21 NUMBER 2
2014

From the Editors

By the nature of its function, the process of educational planning can be classified in many different ways. A common way familiar to everyone is to make distinctions as macro-planning and micro-planning. Within this large range of educational planning space, scholars can further divide it into many philosophical ways, stages and phases. This issue of Educational Planning is devoted to selecting different types of educational planning as examples of different levels of educational setting.

The article by Michael F. Lewis and Walter S. Polka is a retrospective analysis of successful planning processes of student behavior change. This article provides a case study of managing change in the "effective change zone" to promote meaningful and sustaining results of student behavioral management in the classroom.

Derya Yılmaz and Gökhan Kılıçoğlu contributed an article to this issue by identifying views of school principals and teachers about organizational change process at primary public schools in Turkey regarding content, context, process and outcomes dimensions. As a result of in-depth analysis of data, five categories of data emerged generating meaningful directions for effective change processes in school.

Focusing on the provincial and national levels of educational planning, Benjamin Marlin and Han-Suk Sohn co-authored an article to introduce the use of a time phased linear programming manpower model as it pertains to teacher demands in Afghanistan. As a planning and decision making tool, the model includes a sensitivity analysis of policies, assumptions, and uncertainties.

In his article on university planning, Ronald A. Lindahl explored the unique nature of universities and how this helps to define the considerations that must be taken into account when deciding which planning approaches should be used. He urged that university planners must be well versed in all approaches in order to select the one(s) most appropriate for a particular planning endeavor.

Lastly, Kathryn J. Grube's article on white walls in classrooms universally covers all levels of educational planning. Originally, white paint was seen as hygienic and was used to enhance visual capabilities in closed settings. However, she claimed that white walls are proven to cause detrimental psychological effects, such as anxiety, disruptive behaviors, lack of focus, and depressive moods to students and educators that spend time within the space.

Articles selected for publication in this issue are representative of the different levels and scopes of the wide educational planning field. Many areas in this planning field are still unexplored and waiting for all of us, educational planners, to plough and discover. Educational Planning is the journal serving as a unique platform for us to share our new educational planning outcomes and experiences.

May, 2014.

About the Authors

Kathryn J. Grube has fourteen years experience in the architectural millwork, casework, and cabinetry specialties of design, holding a BS in Interior Design and Master of Interior Design (MID). She practices interior design consultation for residential and commercial projects and is pursuing teaching interior design /architecture professionally. Her research focuses on the academic advantages achievable with using color and evidence based techniques that can provide the best possible academic and employment experience for all levels of students, faculty, staff, and administration. Her passions lay in inspiring students to learn and using their talents to become "difference makers" in the design profession.

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Planning to Change Student Behaviors in a Small City School District: A Case Study of Managing in the Effective Change Zone

Michael F. Lewis
Walter S. Polka

ABSTRACT

This article is a retrospective analysis of successful planning processes implemented in an urban school district in the Northeast United States to improve student behavior by incorporating positive behavior activities and strategies as well as infusing more specific character education into the curriculum. The results after three years of planning, implementing, and evaluating the program funded via a federal grant have been impressive. The planning and implementation approaches employed by the district for this program are consistent with those key "high-touch" approaches advocated by contemporary educational researchers and categorized in the planning literature as "managing in the effective change zone". Thus, this paper provides a case study of managing change in the "effective change zone" to promote meaningful and sustaining results.

INTRODUCTION

Urban school districts typically face a plethora of non-academic concerns that directly impact the achievement of students. In many cases, negative behavior of the student within the school or classroom has a doubly negative effect of preventing personal learning and the learning of others. School discipline, which has traditionally focused on a punitive model of punishment for wrongdoing (March, Hawken, & Green, 2003) has not been found to be particularly effective as punitive measures have been found to contribute to negative behavior and school environments which are considered unsafe and hostile (Mayer, 1995).

The faculty and administration of this relatively small urban school district, PreK-12 student population of approximately 7,500, identified negative behavior as a major barrier to student learning. Upon initial exploration, district stakeholders identified a lack of behavior and character education "curriculum" as a barrier to improving student behavior and resultant academic performance. A proactive and preventative approach to addressing student behavior was desired. As research regarding appropriate interventions for this particular concern progressed a combined 'positive-behavior/character education' model was initiated. Based on available research (Walker, Colvin, & Ramsey, 1995; Nelson, Colvin, & Smith, 1996), there was strong support for the use of a Positive Behavior Interventions and Supports (PBIS) model to effect change in the district.

The grant for which the district applied was solely for the purpose of improving individual student behavior from a 3-tiered PBIS model (Lewis & Sugai, 1999) that aimed at addressing the positive teaching and reinforcement of behavior across school-wide, classroom, and individual situations.

Program Implementation History – Year 1

Upon being awarded a federal grant the school district began the planning and program design phase of implementation. The entire 1st year of the program was directed toward allowing staff, administrators, and other stakeholders meaningful amounts of time to design, develop, and articulate program goals, policy, and procedures. This meaningful amount of time allowed for the essential "buy-in" among program originators as well as

staff members and school personnel that were not directly responsible for program development and/or the dissemination of program details.

Year 1 resulted in over 100 hours of professional time spent developing universal district matrices for what appropriate positive behavior and character education program would "look like" as implemented. It also provided for individual schools to consider their own school culture and create a series of recommendations and modifications to the universal system that would facilitate increased acceptance and implementation of the program. A non-exhaustive list of products developed from the year of planning included: 1) district-wide behavioral matrices that specifically defined positive behavior in every physical area of the school (e.g. cafeteria, bathroom, hallway); 2) a schedule that teachers would follow in reinforcing students for overt displays of positive behavior; 3) a series of character traits assigned on a 10-month rotation that would be focused on for the noted month; 4) literary and instructional resources that could be used by teachers for planning lessons that incorporated the specific character trait for any given month; 5) artifacts that teachers and other school personnel could use for supporting the program within the school or classroom (e.g. signs, tickets for reinforcement).

Program Implementation History – Year 2

Year 2 consisted of program implementation based on the aforementioned program developed within Year 1. A full time school counselor was assigned to work directly with staff within the experimental school buildings. Regular "walk-throughs" of the schools were used as means for repeated evaluation of the integrity and fidelity of program implementation. Staff surveys were completed after the first few weeks of school to determine a baseline of student behavior and perceptions of school as a positively engaged community. Consultation from a nationally recognized positive behavior/character education specialist was employed to determine if programming was appropriate, effective, desirable, and had potential for continuation.

Also during year 2, data were continuously collected by an independent data-analysis and program evaluation firm. Measures of office referrals, student suspensions, violent and disruptive incidents, staff perceptions of school as a caring community, and student perceptions of school as a caring community were all collected throughout the year for review and analysis.

The summer of Year 2 was spent reviewing results of collected data regarding program implementation, perceptions, and success. Given the constructivist nature of the designed program a multi-disciplinary team of educators gathered to develop recommended program changes that would increase implementation and success. As a result, several changes were made: 1) tickets used for reinforcement were simplified for teachers to be able to issue more of them; 2) within-year professional development was offered to serve as a "refresher" for the program; 3) the reinforcement schedule was completely overhauled to increase staff acceptance and, importantly, student acceptance of the reinforcement system; 4) reinforcements were changed from tangible goods and items to non-tangible benefits that had no monetary value.

Program Implementation History – Year 3

Year 3 consisted of a continued series of implementation practices. Reviews were conducted by program administrators. Consultation was again provided by a national expert.

Surveys were administered to determine staff and student perceptions of the effectiveness of the programming. School-based data was collected on academic achievement and behavioral incidents.

Upon completing the 3-year, grant funded program, 75% of the schools by and for which this program was developed and implemented elected to continue the positive behavior and character education systems without any future financial support.

PLANNING CONCEPTUAL FRAMEWORK – THE EFFECTIVE CHANGE ZONE

Effective educational leaders engage and support others in the change process by using both their unique leadership artistry and their knowledge about management science (Von Bertalanffy, 1950; Senge, 1990; Norton, 2005). Leaders who implement innovations, such as those involved in this case study, use key organizational planning concepts and focus on the professional and personal needs of change participants. They manage in the "effective change zone" (Polka, 2010).

The "effective change zone" is similar to the "zone of proximal development" for individuals. This is the zone where learning and behavioral change is optimum, "…the point of readiness for a given concept" (Slavin, 2003. p.44). It occurs where "high-touch" interpersonal management practices, based on meeting personal and professional needs, intersect or commingle with the application of appropriate organizational planning concepts (Polka, 2007). Figure 1 illustrates this concept.

Figure 1. The Effective Change Zone (Polka, 2007).

Change planners possessing dispositions congruent with transformational leaders are most efficacious in managing in the "effective change zone" (Polka, 2007). They are proactive, raise the awareness levels of followers about inspirational collective interests, and help followers achieve unusually high performance outcomes (Hoy & Miskel, 2005). They manage the issues in a systematic manner scaffolding complex changes using simple, but sound, planning principles that can be appreciated, articulated and internalized by all involved (Hall & Hord, 2006).

The six professional needs or expectations and the five personal needs or dispositions as well as the four key concepts of sound organizational planning or organizational needs have been identified as significant micro-contextual components for individual satisfaction and organizational productivity in diverse research studies and serve as major "high-touch" references for the effective planning, implementation and sustainment of educational changes (Polka, 2010). This perspective is consistent with the "real change" research of Kotter and Cohen (2002) who stated, "Both thinking and feeling are essential, and both are found in successful organizations, but the heart of change is in the emotions. The flow of see-feel-change is more powerful than that of the analysis-think-change" (p. 2).

The significance of this "high-touch" micro-contextual focus as well as the imperativeness to scaffold in the "effective change zone" are further emphasized in other management of change research,

> Everyone must take responsibility for understanding the concerns that they and other people have about change, and they must also be willing to ask for what they need and be there for others in their time of need … Effective change is not something you do to people. It is something you do with them. (Blanchard & Waghorn, 1997, p. 200-201).

Fullan further corroborates the importance of this perception by insisting that sustainable changes in education are promoted by leaders who help people find meaningful connections to each other in their respective school contexts, "… they find well-being by making progress on problems important to their peers and of benefit beyond themselves" (Fullan, 205, p.104). Change agents and their colleagues learn from each other in the finest Vygotsky tradition, by scaffolding each other in the "effective change zone", using both personal artistry and sound management science principles (Slavin, 2003).

The foregoing concepts related to the significance of attending to the organizational, personal, and professional, and needs of individuals were corroborated by a study of more than twelve hundred (1200) K-12 teachers who identified the importance of interpersonal relationships exhibited by educational leaders who facilitated effective school reforms (Blasé & Kirby, 2000).

CASE STUDY OF EFFECTIVE CHANGE ZONE PLANNING AND IMPLEMENTING

When developing the Positive Behavior Interventions and Supports (PBIS Model) initiative the participant school district administration and faculty, either purposefully or serendipitously, focused on the three primary areas of the effective change zone model as

described in the next three matrices: Table 1. Organizational Needs; Table 2. Professional Needs; and, Table 3 Personal Needs.

Organizational Needs

Educational planning as a strategic process for the improvement of schooling appeared in the educational literature of the early Twentieth Century (Ornstein & Hunkins, 1988). For the past 100 years, educational leaders have employed various planning processes to improve teaching and learning in light of changing societal factors (Brandt, 2000; Brooks & Brooks, 1993; Cook, 1995; Darling-Hammond, 1997; Dewey, 1938; Doll, 1972; Eisner & Vallance, 1974; Fullan, 1999; Freire, 1970; Hyman, 1973; Kauffman, Herman & Waters, 2002; Lieberman, 1986; Norton, 2005). Many of these planning concepts have been correlated into useful paradigms for change in education. Most are based on the premise that sound planning activities for improvement incorporate four key organizational change needs first enumerated by Krug in 1957 consisting of the four Cs: cooperative, comprehensive, continuous, and concreteness. Examples of how the change leaders in this case study school district addressed those organizational needs of the innovation implementers are articulated in Table 1.

Professional Needs

The six professional "high-touch" needs or expectations have been comprehensively articulated in educational research and literature as keys to facilitating changes in professional settings: communication, empowerment, assistance in decision-making, leadership, opportunity for personal growth and time (Harnack, 1968). The significance of these six professional needs as related to effective educational planning activities was reconfirmed by subsequent research studies (Miller, 1981, Polka, 1977, Yuhasz, 1974) and are integral components of contemporary research related to the professional needs of most significance for coping with change (Beane, Toepfer & Alessi, 1986; Brandt, 2000; Hall & Hord, 2006). These six professional needs have also been identified as critical to the successful short-term implementation of innovations and to the long-term sustainability of organizational changes (Fullan, 2005; Kotter & Cohen, 2002; Hall & Hord, 2006). Examples of how the change leaders in this case study school district addressed the professional needs of innovation implementers are articulated in Table 2.

Personal Needs

The six "high-touch" professional needs or expectations as well as the five personal needs (see Table 3) or dispositions of people involved with changes have also been identified as critical to the successful short-term implementation of innovations and significant to the long-term sustainability of the changes (Fullan, 2005; Kotter & Cohen, 2002; Hall & Hord, 2006).

Table 1. Organizational Needs Matrix

Organizational Needs Component	Description of Need	Case Study Application
Cooperative	*Experiencing large groups of diverse stakeholders working in collegial setting to plan for the change.*	Each instance where development of the PBIS model took place was in a structured setting of educational colleagues. Each session was comprised of no less than 6 individuals (inclusive of 1 administrator) from each participating school building plus district administrative representation and other staff, including a school counselor and school psychologist. These sessions included approximately 40 people representing 5 schools, and covering grades pre-K through 8.
Comprehensive	*Considering the vast array of real and potential intervening variables (people, things, and ideas) that impact this change implementation.*	Each recruitment session or planning session allowed for the open and honest sharing of teacher opinion regarding the potential success of the model. These experiences allowed for the PBIS Model to develop in a way that would foster acceptance and reduce opposition to implementation. For example, numerous teachers were concerned with the perception that this model would be in addition to their typical teaching responsibilities. Because of this honest perception, care was taken to more effectively show how the program integrated into the current daily structure and was not in excess of current time spent on instruction.
Continuous	*Monitoring and adjusting of the innovation as the context changes; there are no pre-fixed immutable specific "end date" for the successful implementation of the change.*	At initial conception, development of the PBIS Model was never to be a single instance. Separate from the 12 months of evolved planning, the model was designed to allow for periods of "recalibration" within years two and three. For example, after Year 2, i.e. the first year of implementation, extensive work was done over the summer to revamp the reinforcement structure from lottery-style to menu-style. This was found to be palatable to staff and students alike. Smaller changes made to the behavior matrices and actual items for behavioral reinforcement were also made based on staff input.
Concreteness	*Producing specific artifacts or events related to the innovation in order for participants in the process to have "concrete" evidence that they can identify and celebrate as the outcomes of their collective efforts.*	Three sets of permanent products, dubbed "Behavior Matrices", were developed as concrete artifacts of program development. Each behavior matrix was geared towards a different area of the school building (e.g. classroom, hallway, cafeteria, bathroom, etc.) and operationally defined appropriate behavior in that area. These matrices were also designed in a developmentally appropriate way, where development focused on appropriate behavior and language for pre-K through grade 2, grades 3-6, and grades 7-8.

Table 2. Professional Needs Matrix

Professional Needs	Description of Need	Case Study Application
Communication	*Comprehensively and personally interacting with others about the diverse thoughts and feelings related to the change.*	Educators from all levels of instruction K-8 and from a diverse set of school buildings were selected to participate in program development. This allowed for diverse perspectives to be shared and incorporated into planning sessions. Also, district leadership was sure to express development of this PBIS Model as a district priority with effective supervision and specific collaboration with administrators at all stages of planning.
Empowerment	*Having input to the applications of the changes in work settings.*	Development of this PBIS Model, rather than some other related initiative, was purposeful in that it allowed teachers and education professionals to have significant input relating to application of the changes they wanted to see in their work environment.
Assistance	*Having resource personnel readily available to help scaffold the changes.*	During the initial planning stages and development of this model framework numerous resource personnel were available to help scaffold. Administrators of various levels of education were omnipresent as well as university resources and non-classroom personnel (e.g. school psychologist) to provide for proper assistance in idea development and program decision-making.
Leadership	*Being aware that supervisors are sincerely committed to the change.*	Administrative presence at all planning sessions and continuous direct communication from district and school-building level administration illustrated the administration's support of the PBIS Model.
Opportunity	*Comprehending the personal and professional benefits associated with the change.*	Helping participant teachers develop a functional understanding of the benefits to the proposed model took several forms. First, school administrators were presented the case for the necessity of a character education/PBIS model to be developed. They were then asked to relay this information to school staff. Second, a local expert in PBIS was asked to independently travel to each school and present to faculty about the history of such programs and expected plans. Third, a school district employee then followed up with interested volunteer teachers from each school to answer any questions.
Time	*Experiencing diverse opportunities to reflect about the changes and applying the changes in daily operations.*	One entire calendar year was spent educating staff as to this program, seeking volunteer participation, professional development on character education and PBIS, and program planning and development. Over the two-year span of actual program implementation, continued planning time was permitted in each school to allow guided processing of perceived and actual program effectiveness. Also, time was permitted for staff top make recommendations for programmatic change that would enhance adoption of the Character Education/PBIS model.

Table 3. Personal Needs Matrix

Personal Needs Component	Description of Need	Case Study Application
Challenge	*Visualizing the change as an opportunity for personal and professional growth as opposed to a crisis.*	Addressed during this planning phase of program development as this was the first instance where the participant district was developing a systemic program to develop character education programs and a PBIS model of delivery. This challenge required staff to consider fundamental shifts in disciplinary practices, instructional practices, and overall school-level perspective on the role of the teacher to purposefully instruct and develop behaviors indicative of strong character and positive behavior.
Commitment	*Observing supervisors and other district leaders demonstrating and modeling support for the innovation.*	It could be offered that all of the above referenced "high-touch" concepts within the Personal Needs area of effective change displayed the commitment that is necessary for educators to be able to effectively respond to necessary change. Briefly, commitment was addressed through development of an effective and appropriate number of professional development times to create this model, through provision of substitutes for school-hour development, and through appropriate compensation during non-instructional school hours.
Control	*Believing and acting as if you can influence the course of the change.*	Initially, control was the focus of administration when developing the initial PBIS model. This was evident through the use of approximately 100 person-hours of planning time in developing the model. Volunteer teachers were provided support to work together at numerous meetings over a period of several months to plan the implementation.
Creativity	*Envisioning optimal experiences and new approaches to implement the change.*	Creativity was addressed through this lengthy time of development as creativity was viewed as a supportive process where one can not be expected to 'force' creativity in short periods of time over short pockets of program development.
Caring	*Experiencing a nurturing family attitude at work.*	The lengthy period of planning, where staff were allowed to leave their classrooms and work in small and large groups also supported the concepts of caring as it showed the district's commitment to the teachers' perspectives about the change and the value of their contributions.

Research conducted in 1992, with a sample of two hundred and seventy-nine (279) New York educators, enabled researchers to identify the significance of the above organizational, professional, and personal needs for the implementation of technological changes in education (Polka, 1994). Additional studies replicated that research. Three hundred and twelve (312) educators from two different samples at the end of the 20th century reconfirmed the significance of these "high-touch" micro-contextual needs as key factors to be addressed when dealing with educational changes (Polka, Mattai & Perry, 2000). In addition, two hundred and twenty-nine (229) educators involved in implementing the Georgia Performance Standards verified the significance of these organizational, professional, and personal needs in relation to making major wide-scale state curriculum changes (Polka, 2009). Researchers further analyzing the results of these various studies concluded

that educational leaders must not only be cognizant of these "high-touch" needs but must directly provide for them in a customized manner to promote meaningful and sustainable educational changes (Polka, 2010).

CASE STUDY RESULTS OF MANAGING IN THE EFFECTIVE CHANGE ZONE

As a result of managing in the effective change zone and planning, implementing, monitoring, and adjusting the Positive Behavior Interventions and Supports (PBIS) Model accordingly in this urban school district the following outcomes have been identified:

Superintendent Suspensions

Treatment schools achieved a 38% reduction in the number of Superintendent Suspensions, and a greater reduction in Superintendent Suspensions than the comparison group as identified in Table 4.

Table 4
Treatment and Comparison: Baseline, Target, and Actual Numbers of Superintendent Suspensions

Group	Baseline 2007-2008	Target 2008-2009	Actual 2008-2009	% Change 2007-2008 and 2008-2009
Treatment	32	29	20	38%
Comparison	53	48	41	23%

VADIR reported incidents

Treatment schools achieved a 48% reduction in the number of Violent and Disruptive Incident Reporting (VADIR) reported incidents, and a greater reduction in reported incidents than the comparison group as shown in Table 5.

Table 5
Treatment and Comparison: Baseline, Target, and Actual Numbers of VADIR Report Incidents

Group	Baseline 2007-2008	Target 2008-2009	Actual 2008-2009	% Change 2007-2008 and 2008-2009
Treatment	204	184	95	53%
Comparison	338	304	240	29%

Disciplinary referrals

Treatment schools, as displayed in Table 6, achieved a 70% reduction overall in the number of disciplinary referrals and a greater reduction in disciplinary referrals than the comparison group.

Table 6
Treatment and Comparison: Baseline, Target, and Actual Numbers of Disciplinary Referrals

Group	Baseline 2007-2008	Target 2008-2009	Actual 2008-2009	% Change 2007-2008 and 2008-2009
Treatment	1,929	1,447	588	70%
Comparison	1,025	769	614	40%

Gates-MacGinitie 6th Grade Academic Achievement Assessment

Table 7 indicates that on the Gates-MacGinitie 6th Grade assessment of reading skills, the treatment schools achieved a 10% increase in the percentage of students at or above District standards on the Gates-MacGinitie English Language Arts Assessment for 6th grade, and demonstrated greater improvement than the comparison schools.

Table 7

Treatment and Comparison: Gates-MacGinitie: 6th Grade Only: Percent of Students at or Above District Standard: Baseline, Target, and Actual Percentage

Group	Baseline 2007-2008	Target 2008-2009	Actual 2008-2009	% Change 2007-2008 and 2008-2009
Treatment	78%	82%	86%	10%
Comparison	56%	59%	59%	5%

Gates-MacGinitie 7th and 8th Grade Academic Achievement Assessment

According to assessed results, Table 8 indicates that the **t**reatment schools achieved a 4% increase in the percentage of students who are considered at or above District standards on the Gates-MacGinitie English Language Arts Assessment for 7th and 8th grades, and demonstrated greater improvement than the comparison schools.

Table 8

Treatment and Comparison: Gates-MacGinitie: 7th and 8th Grade Only: Percent of Students at or Above District Standard: Baseline, Target, and Actual Percentage

Group	Baseline 2007-2008	Target 2008-2009	Actual 2008-2009	% Change 2007-2008 and 2008-2009
Treatment	68%	71%	71%	4%
Comparison	75%	79%	77%	3%

School as a Caring Community Profile-II (SCCP-II)- Faculty & Staff

The faculty and staff at the participating schools completed the School as a Caring Community Profile-II (SCCP-II). The treatment group had a higher percentage at the end of the project, than the comparison group, in terms of faculty and staff perceptions about their school being a safe, nurturing, and ethical community as illustrated in Table 9.

Table 9
Treatment and Comparison: Percentage of Staff Perceiving that they work within a Safe, Nurturing, and Ethical Environment

	Pre: September 2007	Post: June 2009	Percent Change
(Ethical)			
Treatment	60%	65%	8%
Comparison	58%	57%	- 2%
(Nurturing)			
Treatment	59%	63%	7%
Comparison	55%	53%	-4%
(Safe)			
Treatment	51%	59%	16%
Comparison	44%	42%	-5%

School as a Caring Community Profile-II (SCCP-II) - Students

Students at the participating schools completed the School as a Caring Community Profile-II (SCCP-II). While, overall, all students perceptions decreased, the treatment group had a higher percentage at the end of the project, than the comparison group, in terms of students perceiving their school to be a safe, nurturing, and ethical community as illustrated in Table 10.

Table 10
Treatment and Comparison: Percentage of Students Perceiving an Ethical Environment

	Pre: September 2007	Post: June 2009	Percent Change
(Ethical)			
Treatment	34%	33%	-3%
Comparison	44%	29%	-34%
(Nurturing)			
Treatment	40%	37%	-8%
Comparison	44%	36%	-18%
(Safe)			
Treatment	44%	28%	-36%
Comparison	52%	27%	-48%

Professional Development

Staff and faculty feedback forms were administered following professional development activities in all three years of the PBIS Project. The feedback from the first year indicated that 100% of professional development participants would implement what they learned and share with other individuals within their buildings. Feedback from the second project year indicated that 58% of professional development participants do include PBIS as a part of the academic curriculum. Feedback from the third project year indicated that 100% of professional development participants indicate that positive behaviors and character education are included as part of the academic curriculum.

End-of-the year focus group

End-of-the year focus group: End-of-the year focus groups were held with representative samples of staff members in both treatment and comparison schools for the last two project years. Focus groups centered on teacher practices related to character education including overall promotion of positive behaviors and the integration of these into the academic curriculum, overall school climate, and school wide support for promoting practices. The correlations between the teacher practices conducive to positive behaviors among students that in turn promote an overall positive school climate were emphasized. Results of the focus group indicate that there is no standardized implementation of positive behavior traits at the building level in the comparison groups like there is with the treatment group. Unlike the treatment group, results of the comparison school focus groups indicate that there is a lack of consistency in how pro-social behaviors are promoted and modeled at the school building level and classroom level.

CONCLUSIONS AND RECOMMENDATIONS

As a result of this retrospective analysis of the focused planning, implementing, monitoring, and adjusting of the Positive Behavior Interventions and Supports (PBIS) Model used in this urban school system case study, it is concluded that any systemic change, or systemic application of a program model, will be accomplished successfully if educational leaders manage in the effective change zone addressing those key organizational, professional, and personal needs of those implementing the change. The PBIS Model has made a significant change in student behavior, academic achievement, and faculty focus on character education in this urban school district. The above identified outcomes illustrate the impact of this program. However, the researchers contend that it was not only the PBIS Model that made the difference but also the way it was planned, implemented, monitored, and adjusted via effective change zone planning addressing the “high-touch” needs of those stakeholders. It was both the content of the change (PBIS Model) and the change process (Effective Change Zone) that both contributed to the success of the change as documented in this case study.

SUMMARY

Contemporary educational leaders or those aspiring to become one, need to focus on attending to those organizational, professional, and personal factors to effectively manage the ever-changing educational landscape of the twenty-first century. They must continuously hone their “high-touch” orientations and interpersonal skills and utilize both their personal change artistry and their management science skills to help their respective employees and organizations adapt to their future. According to Fullan, the sustainability of

school efforts is related to "…continuous improvement, adaptation, and collective problem solving in the face of complex challenges that keep rising" (Fullan, 2005, p.22).

However, it needs to be reinforced that each context is different and the needs of the individuals implementing innovations vary, but planning for change with this effective change zone orientation is a valuable paradigm for educational leaders so that this "high-touch" process for change is given the appropriate priority it deserves. It is predicated on focusing as much, if not more, on the human side of change as it is on the specific programs to be implemented. People make changes happen and leaders who address the needs of the people making the changes are on the path to making those changes successful and sustaining them.

But, as the real world contexts of schools including the people, especially the various stakeholders, continually change; it is important to recognize that the needs of the people implementing and sustaining will change accordingly. The savvy leader recognizes the ever-changing complexities of their respective contexts and plans for change by considering their contemporary human capital factors at each specific time period. The imperativeness of using this "high-touch" needs-based approach to make changes in real world school contexts is consistent with the comprehensiveness advocated by strategic planners,

> "If we are not to dehumanize, oversimplify and artificially make our educational world linear and restricted, it is imperative that we develop strategic plans based upon the actual realities of our organization and society, which are complex" (Kaufman, Herman & Watters, p.109).

Thus, educational leaders who function in the "effective change zone" will be those most likely to plan, implement, and sustain the institutional changes necessary to adapt to current and future educational needs.

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Organizational Change Process: A Study in Turkish Primary Public Schools

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ABSTRACT

The paper aims to identify views of school principals and teachers about organizational change process at primary public schools in Turkey as regards content, context, process and outcomes dimensions. The paper employs a qualitative study internalizing phenomenological approach. Criterion sampling strategy is used to get an in-depth understanding of organizational change process at schools. With a purposive sample of five school principals and five teachers experiencing principal change are participated the study. Participants of the study are interviewed through utilization of semi-structured interviews. As a result of in-depth analysis of data, five categories of data emerged under the factors of content, context, process and outcomes of change. Themes emerged from the study are "exposure for change" as regards localized change initiatives at schools and change initiatives of Ministry of National Education for content dimension; "internal environment" in terms of school principal leadership, demands of students for context dimension; "external environment" regarding competitive pressures, government regulations, changing knowledge and technological changes, standardized schools and demands of parents for context dimension; "process of change" in terms of initiation, implementation, post-implementation for process dimension; "affective and behavioral reactions" as regards resistance and trust for change, openness to change, encourage change, satisfaction for outcomes dimension.

INTRODUCTION

Organizational change

Globalization, developments in information and communication technology, economic crises, demographic changes dramatically forces human being to change structural-functional aspects in his/her systems (Ragsdell, 2000). In other words, *'change'* which is defined as the movement from one state to another (Hargreaves, 2004), is conceptualized as the involvement of organizations in order to respond to increasing diversity of people, advances in information and communication technology, improvements in information processing, dynamic and extensive competition of market place and governmental regulations (Burke, 2008; Dowson, 2003; Moorhead & Griffin, 1995). However, external forces are not the sole triggers of change. Besides, internal factors related to human resources issues and organizational process considerations are critical forces for change within organizations (Ivancevich & Matteson, 2002). The nature of the existing human force within the organization, the nature of the task at hand, the existing structural-functional characteristics, formalized lines of communication, formation of working procedures, managerial hierarchies, reward systems and disciplinary procedures are some of the internal forces of change (Leavit, 1964).

Dimensions of change

Operation at individual, unit and organizational levels, being affected by internal and external dynamics, and having both positive and negative outcomes makes organizational change a very complicated issue. As a result different scholars advanced competing theoretical frameworks in order to conceptualize and implement organizational change process (E.g., Porras & Robertson, 1992; Van de Ven & Poole, 1995). Based on a review of 10 years scholarly works on organizational change, Armenakis and Bedian (1999) suggested a comprehensive framework for conceptualizing organizational change process. They suggested that organizational change analyses need to consider *content, context, process* and *outcome issues* (Armenakis & Bedeian, 1999).

Within this framework, the content of organizational change answers the question of *'what to change'* with antecedents and consequences of change practices by providing vision and directing for change (Armenakis & Bedeian, 1999; Burke, 2008). In fact, content issues for organizational change include some major themes like mission, vision, strategy, and purpose of the organization, changes in organizational structure, technology, physical setting, leadership, job tasks and on-the-job behavior (Armenakis & Bedeian, 1999; Porras & Robertson, 1992). However, not all organizations experience same changes; some organizations perform incremental changes while some of them experience radical changes. More specifically, transformational change that can also be accepted as radical change leads to change in organizations or component systems by shifting in their mission, underlined values, beliefs and organization structures. The other form of organizational change which is incremental change, also called as transactional change, brings new products, new systems, new technologies and processes to particular set of unit or division within the organizations (Schermerhorn, Hont & Osborn, 2005).

The context of organizational change comprises external and internal environments influencing change (Armenakis & Bedeian, 1999). In that sense, external context factors encompass competitive pressures, governmental regulations, legislative and technological changes (Edelman, 1990; Hannan & Freeman, 1989; Tushman & Romanelli, 1985) while internal contextual factors cover some topics such as leadership, organizational culture and climate, change history of organization, attitudes towards change, trust in executive management and supervisor, participation and communication in change process (Armenakis & Bedeian, 1999; Bouckenooghe, 2009; Damanpour, 1992; Devos, Buelens & Bouckenooghe, 2007).

Process factors that can contribute to successful change efforts account for the question of 'how and why to change' by considering processes of organizational change (Burke, 2008). Indeed, the complex psychology of change includes processes during planning and implementation of change (Armenakis & Bedeian, 1999). Indicators of change process are determined as change communication quality, participation, top management's attitudes towards change and support by supervisors (Bouckenooghe, Devos & Broeck, 2009).

Studies on the process of change provide some models emphasizing phases for implementation of change. To illustrate, Kurt Lewin's notion of unfreezing, moving and refreezing steps form the conceptualization of change process (Lewin, 1947). In the first step, present level of behavior is unfrozen by showing the discrepancy between current state and desired end state of the organization. The second step, moving the behaviors, values and attitudes of the organizations shifted to a new state through changes in organization structures and processes. The refreezing step establishes new state of the organization by means

of using supporting mechanisms (Burke, 2008; Cumming & Worley, 1997). Once Lewin provided organizational change processes, Schein and Lippitt elaborated Lewin's three stage change process procedure (Schein, 1987; Lippitt, Watson & Wesley, 1958). Specifically, Schein expanded the Lewin's three stages into three steps: unfreezing, changing and refreezing. Unfreezing of an organization is achieved by creation of motivation and readiness to change. Changing step includes cognitive restructuring of the organization while refreezing stage involves integration of organization members for change (Schein, 1987). Besides, Lippitt's three faces of change covers the need for change, creation of a need development of change relationship between change agent and organization, implementing change, stabilizing of change and providing a termination in the relationships between change agent and organizations (Lippit et. al., 1958). In addition to these process models, recent studies such as Kotter (1995), Galphin (1996), Armenakis, Harris and Field (1999) also proposed widely used change process models.

On the other hand, process of change can also be analyzed by considering theoretical framework behind change process identified by Van de Ven and Poole (1995); with life cycle, teleological, dialectical and evolutionary theories. In fact, *life-cycle theory* explains change with a serious of predetermined stages by setting institutional rules and developmental activities that the organizations have experienced in order to reach subsequent end state whereas *teleological theory* explains change as consequences of purposeful and adaptive acts without setting sequence of stages and prescribing prefigured rules. *Dialectical theory* elucidates change as the resolution of two different oppositions by producing a synthesis while *evolutionary theory* explains change as ongoing process that the organization is never static with a continuing competitive survival among organizations (Van de Ven & Poole, 1995).

As regards outcome factors, affective and behavioral reactions towards change are involved as reactions of the people within an organization. Indeed, affective and behavioral actions across a change intervention can be evoked by the members of the organization (Armenakis & Bedeian, 1999). Attempts for coping with uncertainty of change are denial (e.g. thinking change is not needed) and resistance to change (e.g. absenteeism, sabotage, stalling, turnover), feelings of stress and cynicism, and reduced organizational commitment (Jaffe, Scott & Tobe, 1994). In addition to unintended responses, people may elicit affective reactions like commitment with showing psychological attachment toward organization, job satisfaction, anxiety, exhaustion and depression towards change.

The meaning of educational change

Current economic, social and political forces have combined to generate a climate that influences schools by imposing a feeling of a pressure to change. Indeed, technological advances and changing marketplace in the society influence the structure of educational systems. Ideologically, technologically and demographically change of society, changing individual child and family needs are all reflected in curriculum developments regarding personal and social education areas. Therefore, change in the environment has played an important role on education (Newton & Tarrant, 1992).

The scholarship surrounding educational change states the complexity of the phenomenon. Educational change is described by Fullan (1982, 1993, 2007) as a multidimensional process. He points that educational change is not a single entity even though simple level of innovation in a classroom is utilized (Fullan, 2007). Actually various type of change agents

in schools have roles in change process by influencing innovation decisions for a desirable direction (Rogers, 2003). Hereby, specific educational changes are embraced due to being desirable depending on certain educational values and meeting a given need better than the existing practices (Fullan, 2007).

Change process in schools can be handled in three broad phases in relation to outcomes: initiation, implementation and continuation and outcome as it is clear from Figure 1. In the first phase, which is also labeled as mobilization or adoption involves the processes leading up and comprising a decision to adopt or proceed with a change. It may take different form taking in a decision of a single authority or a broad base mandate. There are various factors affecting whether a change is initiated. These sources influencing initiation are existence and quality of innovations, access to innovations, advocacy from central administration, teacher advocacy, external change agents, community pressure, new policy, and problem-solving and bureaucratic orientations. Implementation or a phase of attempted use involves the first experiences of attempting to put an idea or reform into practice. In fact, implementation consists of the processes that put an idea, program, set of activities or structures new to the people into the practice. In this sense, implementation is considered as the means to achieving certain outcomes. Characteristics of change for different stakeholders in local and governmental levels in terms of need of change, clarity about goals and needs, complexity; local factors like school district, principal, teacher, board of community and external factors such as government and other agencies are identified as factors affecting implementation process in schools. Continuation which is also called as institutionalization, incorporation or routinization is an extension of the implementation phase and refers to whether the change builds as an ongoing part of the system or becomes unnoticeable with a decision of discarding or by attrition. Specifically, continuation means decision about institutionalization of an innovation based reactions to change that depends on the implementation of the change into the system through policy, budget and time; committed and skilled school members and establishment of procedures for continuing assistance. In the end, these three phases are related to outcomes that refer to several different results depending on the objectives, especially whether or not the objectives are achieved, whether or not student learning is enhanced, and whether or not experiences with change increase subsequent capacity to deal with future changes. On the other side, outcomes could involve improved student learning and attitudes; new skills, attitudes, or satisfaction of teachers and other school personnel; or improved problem-solving capacity of the school (Fullan, 1982; 2007).

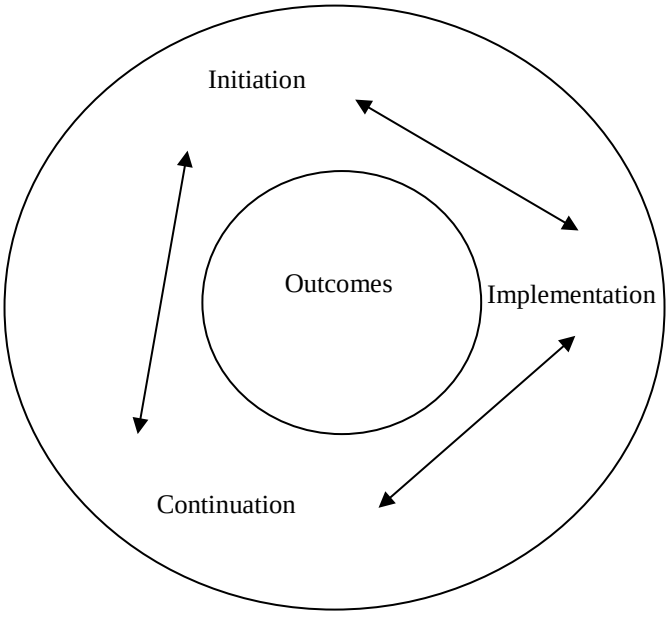

Figure 1. A simplified overview of the change process

Change in school organizations is complex and difficult to achieve. Without discussion of the change process, problems and the power that change creates may not be understood in schools. For successful implementation of an educational change, dynamics and implications of change should be understood effectively. However, most schools handle the issues just inclosing educational innovation rather than studying the change process itself (Speck, 1996). At his point, it is necessary to consider three elements that cover beliefs and values as regarding what should change, knowledge and skills necessary for achieving change and outcomes in terms of indicating success (Timperley & Parr, 2005) and to internalize the suggestions provided by Fullan (1993); ability to work with polar opposites should be attained, dynamic interdependency of state accountability and local autonomy should be set, individuals and societal agencies should be combined, internal connection with the organization and external connection to the environment should be done.

CHANGE PROCESS IN TURKISH EDUCATIONAL ORGANIZATIONS

Turbulent external environments and dynamic internal environment are equally valid for educational organizations as well. These developments pose pressure on educational organizations to change aspects in their structural-functional characteristics. In fact, educational organizations also need to create more effective learning environments, respond educational needs more efficiently, generate knowledge, skills, attitudes and understandings for meeting the social needs of future, be flexible and develop organizational strategies in order to ensure sustainability and development of the individual and social life for getting individuals ready for change considering the needs from outside or inside the education system (Gökçe, 2005; Rosenblatt, 2004).

In parallel with global developments especially in the last quarter of the last century, changes concerning content and presentation of educational programs, educational technologies, learning-teaching process and the roles of teachers and students come forward in Turkey. Thus, flexible and a frame curriculum approach; constructivist understanding that possesses characteristics of pluralism, highlights uniqueness and diverseness, and focuses the attention to learning take part in traditional education approach aiming to teach compliance and obedience (Akpınar & Aydın, 2007; Hesapçıoğlu, 2001). Hence, understanding change in educational organizations and developing guidelines for practices become the top items in the agenda of educational scholars.

In Turkish Education System there are many change initiatives launched by Ministry of National Education (MONE) aiming at improving education quality by developing and disseminating innovative and research based education programs (Akşit, 2007; Gökçe, 2009), improving the quality of teacher, training information age individuals, bringing schools as learning organizations, creating democratic school cultures, and adopting development and modernization from pre-school education to higher education at all levels of education (Şişman & Taşdemir, 2008). Furthermore, MONE that generates educational politics concerning Turkish Education System by means of its centralized structure, transfers its authority in decision and control processes to schools anymore. Besides, MONE starts to improve administrative effectiveness of school managers, gets utmost benefit from information technologies in both administrative mechanisms and educational processes, and continues organizational restructuring practices within its organizational management scheme.

PURPOSE AND SIGNIFICANCE OF THE STUDY

In this context, developing technology, changing social structures and fluctuating economy create new environments and force structure of MONE and schools for change. Specifically, 36 thousand primary public schools with 410 thousand teachers and 12.5 million students constitute the basis of Turkish National Education System (MONE, 2011) and experienced changes in MONE deeply influence administrators and teachers of these schools. Therefore, studying views of teachers and school managers about change processes in schools will contribute to widening conceptual understanding of change initiatives in schools as well as generating practical guidelines in the implementation of change processes in educational context. Although there are numerous studies on organizational change in schools, these studies are based on local experiences of the authors, reflections on change implementation or presentation of narrow cases. Hence, this is a need for comprehensive investigation of change process in educational organizations by emphasizing different dimensions of the process. Based on these arguments, the purpose of this study is to identify views of primary public school principals and teachers on the content, context, process and outcomes dimensions of organizational change process in educational organizations. More specifically, the following research questions served as a guide for the study:

1. What kind of change took place in schools?
2. What are external and internal environmental forces influencing change in schools?
3. How do primary public schools undergo organizational change process?
4. What are the reactions towards change initiatives in schools?

Defining and understanding the phenomenon of change process from school princi-

pals' and teachers' perspectives and experiences is valuable for educators to implement successful changes. If the conditions for engaging in a meaningful change process and impediments and obstacles hindering change process are understood better, the school and the teachers will create and sustain change initiatives effectively. In this respect, this study contributes to the literature that indicates what the major factors in change process are and how organizational change process is handled in schools. In the literature, it seems that studies regarding attitudes and behavioral reactions towards change process are conducted. Actually, there is limited amount of available knowledge involving teachers' and principals' detailed roles and perspectives about change initiatives and what kind of stages are adopted within change process. Therefore, this study provides contextual-rich descriptions about change process in primary public schools. In addition, what sort of triggers and outcomes accompany change process will be learned. In short, this study will allow a comprehensive understanding of an organizational change process in primary public schools from the experiences of school members.

METHODOLOGY

In order to comprehend organizational change process in primary schools with regarding the perspectives of teachers and school principals in their natural setting, qualitative research is utilized for the study. For eliciting the meaning of lived interactions takes place during change process in primary schools for several individuals considering internal and external environments, and for understanding the essence of experiences about organizational change, *phenomenological approach* is internalized (Cresswell, 2006).

Qualitative research design is considerably lean on in-depth interviewing (Marshall & Rossman, 2006). By means of using interviewing, participant's perspectives, experiences, feelings and insights on the phenomenon of interest are arisen explicitly (Bogdan & Biklen, 1998). In order to uncover perspectives and experiences of teachers and school principals about change process in primary schools, one of the most frequently used methods in qualitative research, interviewing is used as data collection method for this study. By means of using interview as data gathering method in this study, emic perspectives of principals and teachers are obtained and the meaning of organizational change process in primary schools is derived.

Participants

The sampling of the study depends on one of the strategy of *purposeful sampling* which is *criterion sampling*. Since the purpose is identifying and getting perspectives of the ones who had experience with change interventions, criterion sampling was effective in serving this purpose. The basic criterion for sampling strategy of the study is contingent on 'change of the school principals within one year'. With this criterion, a purposive sample of five school principals and five teachers working at public primary schools in Eskisehir with experiencing principal change accompanied by educational change in these schools participated in this phenomenological study. Participants of the research whom are school principals are all men while teachers are all women. Professional experiences of school principals vary from 8 years to 11 years while teacher participants' experiences range from 6 to 14 years. Of the teacher research participants, three of them are classroom teachers whereas the remaining two are mathematics teachers.

Data collection procedure

Participants of the study, five school principals and five teachers, are interviewed face to face through utilization of *semi-structured interviews*. Indeed, semi-structured interview is used due to being flexible and allowing new questions to rising during the interview (Bogdan & Biklen, 1998; Patton, 1990). During the development of interview schedule, related literature was reviewed comprehensively to construct the framework and to prepare qualified interview questions tailoring change concepts. In fact, draft version of interview questions comprising 35 questions, including three warm-up questions for obtaining participants' demographic characteristics, are formulated. Draft version of interview questions then reduced to 18 questions through consulting a qualitative research specialist and two educational administration field specialists in order to elicit the evaluation to what extent the questions address the purpose, and what is the comprehensibility and feasibility of the prepared questions. The pilot study is conducted by interviewing with a school administrator and a teacher for acknowledging understandability and capability of the questions to be carried out. After the information gained from specialists and the feedback from pilot study, interview questions schedule is shaped with its latest version to be served for data gathering.

Interviews are conducted with the participants by considering Kvale's (1996) key strategies for qualitative research interviewing such as taking attention for the answers without deviating from the purpose, recording the interview with getting participants' consent, acquiring deep and rich information, not intervening the ideas of participants, obtaining long answers compared to directed questions. Recorded interviews are then transcribed and a table of 10 interviewees is drawn up with noting key issues and quotes from the transcripts for identifying the underlying themes in the data. In this context, school administrators are coded as *SA*, teachers are coded as *T* and each participant was given number.

Research data is analyzed through *content analysis*. In fact, content analysis requires deeply analysis of gathered data and provides opportunity for arising of themes (Strauss & Corbin, 1990). During the process of analysis, the views of participants are coded through creating general accounting scheme which is partway between provisional coding and inductive coding. By means of general accounting scheme guided, general categories are driven from the literature and codes are developed inductively (Miles & Huberman, 1994).

Transcribed data are read by the researchers and codes are structured until categories are saturated. In order to ensure definitional clarity by check-coding, as well as reliability, both of the researchers coded data separately and codes are then reviewed. Intercoder reliability of the study is accounted via the formula of reliability = number of agreements / (total number of agreements + disagreement). Eventually, 88% intercoder agreement is attained. Due to being above 70%, reliability of the data is assumed to be ensured (Miles & Huberman, 1994). Codes having correspondence with each other are taken to clump into broader sub-categories with leaving incongruent codes out of the analysis. In the following, content analysis is performed with organizing categories and generating themes of the study.

Internal validity (credibility) of the study is ensured through member checking by examining driven interpretations and conclusions with interviewees and keeping the duration of interviews long in order to establish credibility (Lincoln & Guba, 1985). External validity (transferability) of the research, to what extent the findings can be transferred into another setting, is attained by means of thick descriptions while presenting the findings

(Lincoln & Guba, 1985). On the other side, internal reliability (dependability/consistency) is achieved by dependability audit through inspecting the process and product of the research (Erlandson, Harris, Skipper, & Allen, 1993). External reliability (confirmability) is established by conformability audit with two experts through enabling independent examination of entire research process from data gathering to data analysis to determine to what extent the findings are not influenced by biases (Lincoln & Guba, 1985; Miles & Huberman, 1994). Hence, assessment of auditors is ensured whether or not the findings are grounded in the data, inferences are logical, biases are identified, and methods for trustworthiness are established.

FINDINGS

As a result of in-depth analysis of the data from 10 transcribed interviews with five school administrators and five teachers, five categories are organized by four dimensions common to change which are content, context, process and outcomes: *exposure for change* as regards localized change initiatives at schools and change initiatives of MONE, *internal environment* in terms of school principal leadership, attitudes towards change, demands of students; *external environment* regarding competitive pressures, government regulations, legislative and technological changes, standardized schools and demands of parents; and *process of change* in terms of initiation, implementation, post-implementation; *outcomes* as regards affective and behavioral reactions. Interview results are organized according to findings of the study are presented in Table 1.

Table 1
Categories and sub-categories emerged from data analysis

Categories	Sub-categories
1. Content	-change initiatives of MONE
-exposure for change	-localized change initiatives
2.Context	-school principal leadership
-internal environment	-demands of students
-external environment	-competition
	-governmental regulations
	-changing knowledge and technological changes
	-standardized schools
	-demands of parents
3.Process	
-process of change	-initiation
	*change initiators
	*decision for change
	*planning for change
	-implementation
	*communication
	*participation
	*management of change process
	-post-implementation
	*sustaining change
4.Outcomes	-resistance for change
-affective and behavioral reactions	-trust for change
	-openness to change
	-encourage change
	-satisfaction and happiness of parents, teachers and students

What kind of change took place?

Changes took place within five primary public schools are examined through considering the act of exposure for change within these schools in order to comprehend the content of change practices. The data gathered thorough interviewing school administrators and teachers revealed that change interventions were designed and introduced by both MONE and primary public schools themselves.

The results of the interviews with school principals and teachers showed that main topics that *change initiatives performed by MONE* are: curriculum change in primary public education, transition from teacher-centered education to student-centered education by adopting constructivist approach, e-school system, TEFBIS (Turkish Educational Finance and Education Expenses Information Management System), distribution of textbooks by MONE, abolishment of SBS (placement tests) in primary public schools, designation and replacement regulation of school principals like rotation of school administrators, changes in primary public school regulations, FATIH Project (Increasing Opportunities and Enhancement in Technology Movement Project), giving importance to values education by policy of ministry, IKS (Standards for Primary public Schools), electronic designation, electronic application for in-service training and replacement by score initiatives, total quality management and strategic action plan applications in the schools.

Of the teacher participants, T1 stated that "Curriculum has been changed, change in curriculum brought about changes in the courses. There was a teacher-centered education before, now education totally is student-centered, we solidify courses with activities and implementations." About changes of MONE in the name of transparency, SA1 mentioned "Changes we need to put forward as transparency are e-school which introduces information areas to all stakeholders outside the school, TEFBIS which is finance information system". On the other side, T1 sees abolishment of placement tests in primary public schools as one of the important change practices performed by MONE with the statement "There are placement tests. Beforehand, the exam was given 6^{th}, 7^{th} and 8^{th} grades of primary public schools, next year it will be given only 8^{th} grades."

On the other hand, findings of the study revealed that major topics as *change practices adopted by primary public schools* can be grouped as change initiatives in physical structure of the school and change practices about education. Ergonomic school building establishment, change in school garden, corridors, stairs, external school door and boards, library establishment, insurance of the school, window repairing, installation of air-sterile devices, preparation of Atatürk (founder of Turkish Republic) corner, creation of more clean school, renewal of the laboratory, repairing of toilets, construction of playgrounds, providing security guard and ensuring personal student cabinets are the main change practices come forward in the physical structures of the school. Whereas, change initiatives related to education in the schools are use of information technologies in classes (E.g. smart boards, computer, projector, software program purchase, simulations, animations in lessons and high speed internet), introducing class system, use of white board, creation of classroom rules, getting photocopy machine and printer, providing special desks for classes, opening of preschool class, providing study rooms and change in school dresses.

When the views of participants are taken as regards change initiatives experienced in the schools, most of the participants believed that these change efforts are related to changes in internal and external physical structure of the school. About these changes in the *physical structure of the school*, one of the school principal SA3 stated that "We have

painted the school, hang on board, and bring liquid soap system to toilets." and one of teachers T2 mentioned that T2 "Each year our classes are renewed in terms of technology, and new classes are constructed. Deficiencies of the classes are also completed. Student cabinets are constructed in primary public level classes; each student has his own cabinet now."

In the context of *educational changes* in the schools, majority of the participants mentioned changing and utilized information technologies and they asserted that adapting these changes to classes is considered as change intervention. Related to educational changes, of the participants, SA1 places the following statement "We have started internet supported and projector supported education and training." and SA2 points out "Our school utilizes information technologies; specially, placing smart boards in classes enables providing the education in an interactive environment." As another example for educational changes that are experienced in the schools, SA1 perceives practiced change implementations like dressing of students and arranging class system in the school as educational change implementations.

What are external and internal environmental forces influencing change?

Internal and external environments of five primary public schools which change implementation occurred are examined by taking account the conditions surrounding changes for understanding the context of change practices. The interview results show that internal contextual issues and external forces come forward regarding conditions surrounding change practices in primary public schools.

In terms of *internal environmental issues*, core categories of data emerged from the analysis are leadership characteristics of school principal and demands of students. Interviewed school administrators and teachers are provided different views about school principal leadership. The results show that communication ability, convincing teachers about change, being determined about what to change and making last decision about change are main leadership features.

Of the school principals, SA2 takes care for the importance of communication skill by claiming "In the context of change, how you say something is more important than what you say. The way of your approach affects the person in front of you." Besides, SA1 states the importance of convincing people for change by emphasizing that "I believe change then I try to convince people for change. I struggle, I never give up but I can face with some people who don't believe. I try to persuade the personnel when they approach a project in a prejudicial way." SA3 mentions the importance of school administrators being decisive in change process and preparing the infrastructure of change before initiation.

Participants add demands of students as internal forces influencing change in schools. Of the teachers, T3 stresses development of students as internal factor with the statement "Students are changing; they are in a continuous improvement." On the other side, of the school administrators, SA1 believes that students are considered as internal factor for determining school's change need with addressing "We take attention for student boards, student committees while identifying change needs."

As regards *external forces*, competition, governmental regulations, changing knowledge and technological changes, standardized schools and demands of parents are main themes emerged from data. Of the school administrators, SA1 takes the attention to rapid changing world and competition by the statement "Competition, competition, competition.

While the world has been changing continuously, you cannot withdraw into your shell with being nonchalant. You absolutely need to keep up with this change." SA2 emphasizes renewed regulations as external factor influencing change practices by saying that "We do our work through the boundaries of regulations. Therefore, we face with continuously changing situations. Of course it is necessary to be up-to-date. It is necessary to follow regulations." The importance of technological changes is also pointed by SA4 through "Where technology is arriving at and how we move depending on this? We need to reconcile education technology with this era." In addition to changing technology, SA2 mentions as well as changing knowledge by stating that "Rapid renewal of knowledge and technology. Especially knowledge is changing vigorously anymore; therefore, something you learned can move to different dimension ten minutes later." School principal SA3 indicates standardization of schools and change demands of parents are the compelling factors for change with the expression of "Recently, schools have standards as regards education and training. You try to bring your educational standards near to other schools' that are in other cities; then, you try to respond parents' needs concerning change and education." Parallel with the ideas of SA3, T5 points out that change practices are experienced considering parents' demands with the statement of "In change interventions; firstly, needs of environment and needs of parent profile are talked about and discussed; then, change plans are done and innovations are performed depending on these."

How do primary public schools undergo organizational change process?

Change implementations at schools are scrutinized under three stages: initiation, implementation and post-implementation. As regards *initiation stage*, participants mentioned initiators of change practices, process of decision making, and planning for change in schools.

When participants' views are taken concerning change initiators, majority of the participants point school administrators as change initiators in their schools. Of the school administrators, SA4 denotes that "Change initiator in a school is exactly the leader of the school, school manager." Likewise, other school administrators and teachers label school principals as change leaders at schools. Besides, school administrator SA3 also mentions other school members as change initiators with the statement "At first school principals of course, assistant school administrator, then teachers. Sometimes an attendant can be."

Related to teachers' and school principals' thoughts about decision making process before change interventions, SA1 pointed out those thoughts of colleagues, students and parents are taken into consideration through participation into decision making process. Likewise, SA4 asserts that decision making process is initiated through exchange of ideas and consulting stakeholders' thoughts by saying "During decision making process, we are willing to participate our colleagues to the process. May be our parents, MONE, universities, non-governmental organizations and industrial units. We pay attention for collaboration with organizations that directly or indirectly influence the school. We take their thoughts. Then, we pass to implication."

School administrators and teachers also emphasize the importance of planning of change and task sharing during decision making process. Indeed, SA5 points out significance of short or long term change plan and determining individuals having roles in change process with his expressions "While deciding for change, you also do planning; short term or long term. Afterwards, you designate roles in change process; you identify the individ-

uals with their roles." Similarly, T5 declares planning for change process with the expression that "Issues that will go over change is negotiated. Depending on this negotiation, change plans are done and innovations are implemented." Other from these, sustainability and economy of change, keeping up with developing technology are considered as important factors for decision for change by school principals.

In terms of *implementation stage*, foremost themes resulted from interviews with teachers and school administrators are communication, participation and management of change process. In the implementation process of change practices, participants mention the importance of communication. Specifically, communication of change is achieved through hanging an official document on the board or talking with people. On the other side, SA4 states that the administrator starts communication process of change and interviews with teachers. SA1 denotes taking care of using common mind with teachers in change process. Of the teachers, T1 mentions performed interviews by school principals with teachers concerning change implementations, sharing of thoughts and positive communication between each other.

Of the participants, T2 mentions the importance of participation to change practices during implementation stage through teachers' endeavors and supports. Similarly, , SA2 also states that school administrator should plan and control change process by saying "It is necessary to explain what is changing and its contributions to our school. Moreover, change is not performed without planning. Change is not a phenomenon performed randomly and developed spontaneously. Therefore, you need to control and be in charge of the process." Related to management of change process during implementation stage, T4 denotes coordination of process and reporting as controlling by the statement of "After division of work for change intervention, reports are demanded for some of the works and meetings are done. Who fulfills his work and to what extent he does are controlled."

As regards *post-implementation step* during change process, the findings of the study highlight the theme of sustainability of change. When the views of teachers and school principals about sustainability of change interventions are investigated, similar thoughts between teachers and school administrators stand out. Of the school principals, SA2 emphasizes that "How we sustain change? Actually, established system and effective management of the process are already preserving itself. There is no need for you to extra effort. It is already going spontaneously." Moreover, T5 focuses that if the implementation phase is overcome, there will be no problem while sustaining change. Likewise, school administrators, SA1 and SA3, also take the attention for owning change and presenting determinism in sustainability of change interventions.

What are the reactions towards change initiatives?

The outcomes of change interventions can be considered as affective and behavioral reactions towards change. The interview results showed that teachers exhibit negative attitudes towards change at first, they exhibit *resistance for change* and they do not immediately accept change due to being afraid; however, if they *trust for change* with its benefits, they accept change interventions. Moreover, school administrators take the importance of trust for change, being excited and fostering enthusiasm for change whereas teachers specified that they generally have positive attitudes towards change, even though some of them are not warm to changes, they support experienced change interventions and indicated that

their school principals are *open to change* and *encourage change practices* in the schools. Of the school principals, SA3 focuses on resistance for change at the beginning of change attempts and senior teachers' resistance for change practices in the school by stating that "During change intervention, you firstly face with resistance within the organizations since individuals do not give up their old habits. Even though you formed or implemented your own rules based on legislations and laws, you faced with resistance." and "If you have senior teachers in your school, you perform change practices more difficult."

When the participants are asked to evaluate the results of change practices in their schools, school principals and teachers stated that change interventions create *satisfaction and happiness of parents, teachers and students*. Of the school principals, SA4 takes the attention of parent and student satisfaction "From these changes, especially parents and students are very pleased. Parents are very satisfied and they said that the school principal should come here years ago. Indeed, they are very happy and parent support is very much." Likewise, SA2 mentions the facilitation of teachers' work and their pleasure through change interventions with the expression of "Our colleagues are so pleased from change practices. Indeed, they come to my room and present their appreciations."

DISCUSSION AND CONCLUSION

Change implementations at public primary schools in Turkey are analyzed depending on four research themes common to all change efforts by considering the interviews with school principals and teachers because congruence between content, context, process and outcomes of change determines the success of change efforts (Damanpour, 1991).

In terms of content of change in schools, interview results showed that change implementations are under the monopoly of MONE and local primary schools. Specifically, MONE performed such change implementations within public primary schools: educational changes such as curriculum change in primary education, transition from teacher-centered education to student-centered education with embracing constructivist approach, values education by policy of ministry, distribution of textbooks by MONE, division of books into textbooks and workbook, abolishment of SBS (placement tests) in primary schools, system in reading-writing-learning (hand writing), and changes in regulations and offered services influencing schools like primary school regulations, e-school system, TEFBIS (Turkish Educational Finance and Education Expenses Information Management System), designation and replacement regulation of school principals like rotation implementation for school administrators, FATIH Project (Increasing Opportunities and Enhancement in Technology Movement Project), IKS (Standards for Primary Schools), electronic designation, electronic application for in-service training, new total quality management and strategic action plan implementations. These changes fulfilled by MONE can be considered as radical changes due to restructuring of Turkish Education System by adopting new component systems (Schermerhorn et al., 1994). In fact, these change practices are intense and encompassing education system of primary schools. These organizational changes are beyond the primary schools so that organizational change practices are initiated by one of the main external force, MONE, to come up with changes in competitive environment, government regulations and technological developments. Since practices of MONE deeply alter entire education system as regards mission, culture and strategic direction, these change implementations can be seen as transformational rather than being transactional

(Burke & Litwin, 1992). Due to touching core of the school organizations by transformation of schools with being revolutionary, these radical changes can be seen as second-order changes (Levy & Merry, 1986). On the other side, as individualized schools, public primary schools carry out changes peculiar to their schools like change initiatives in physical structure of their school, change practices about education and change implementations outside their school. These changes generally comprise school building repairing in different areas and espousing information technologies in classes for educational development by means of purchasing new technologies. These changes can be accounted as incremental changes since these initiatives enhance existing structure of schools being equipped with new products and new systems (Schermerhorn et al., 1994). Actually, these incremental changes are designed to improve efficiency in school, not inducing deep structure of educational organizations. Since these changes are short term practices at primary schools, these alterations can be accepted as transactional (Burke & Litwin, 1992). Due to being small-scale and less-drastic changes with enhancing efficiency within the organization, these transactional changes in primary schools can also be considered as first-order changes (Levy & Merry, 1986).

As regards context of organizational change at primary schools, internal and external forces affecting change need to be mentioned since these factors shape environment of the organizations (Armenakis & Bedeian, 1999; Finstad, 1998). In that sense, educational organizations are said to be open systems interacting with other systems and outside their environment. As being open systems, structures and activities of the schools are influenced by their external environment. Actually, there are countless variables potentially influencing whether a change program is started in schools and changes get initiated from many different sources and for many reasons (Fullan, 2007).Social, political, economic, technological and demographic propensities of external environment affect school organizations (Hoy & Miskel, 2008). In this study, interviews with school administrators and teachers revealed that external contextual factors and internal environmental forces influence primary schools towards change interventions. In fact, school principal's leadership characteristics and demands of students are emerged factors underlining internal environment of the primary schools. In terms of leadership characteristics of school principal, communication ability, convincing teachers about change, being determined what to change and making last decision for change are the basic contextual factors that have important roles in organizational change process. Whereas results revealed that competition in the world, renewed regulations of the government, changing knowledge and technological changes, standardization of schools, demands of parents are identified as external forces driving primary schools towards change. That is, change agents external to the schools districts like regional, state or national facilitators play an important role in initiating change projects (Fullan, 2007). In that sense, the findings are parallel with the related literature. Specifically, external context factors that is profoundly affect organizational change can be determined as governmental regulations (Kelly & Amburgey, 1991), legislative and technological changes (Haveman, 1992), and competitive pressures (Meyer et al., 1990), standardized schools and demands of parents. Similarly, Töremen (2002) also asserted the same conclusions about major reasons leading school change as external pressures; such as changing regulations and legislations, crises and conflicts and ineffective communication. When internal and external factors influencing change are considered as a whole, school principals as change leaders are need to take attention these issues in order to perform

successful change interventions at their schools. Still other internal and external forces for change at primary schools are perceived as demands of students and parents. However, it is obvious that no demands come from teachers even though they are the actors of change whom put change initiatives into practice in the schools. The reasons behind why change demands do not come from teachers may stem from teachers' afraid of change, not undertaking responsibility and not receiving overload in the schools.

At the beginning of this change process, findings of the study concluded that teachers *resist for change* due to being afraid of change initiatives; however, school principals' being determined and using effective communication ability and convincing teachers about change lead to breaking down teachers' resistance for change. At this point, teachers' performed resistance for change can be accepted as *blind resistance* and *political resistance* since teachers are afraid of change with being prejudiced at first and they feel that their stakes are in danger (Hambrick & Cannella, 1989). If favorable returns of change interventions are considered, blind and political resistance of teachers against change initiatives without scrutinizing the content of change and its benefits, with the anxieties of not sustaining the old habits and corruption in their orders, may influence efficiency and development of schools negatively. This situation shows that teachers are almost positive about change and participated in different school development projects. Therefore, it is concluded that teacher advocacy of change is adopted well and change ideas are supported by teachers (Fullan, 2007). In case of this situation, school principals have important roles. School administrators' behaviors as being determined and persuading teachers by effective communication to perform change interventions present ways for coping with change (Caruth, Middlebrook & Rachel, 1985). In addition, school principals are seen as *open to change* with being willing to support change even though they are exposed to MONE's change practices or implement their unique change initiatives for their schools. At the same time, school principals form infrastructure for change practices that will provide benefit for the school and they get teachers to make them ready for change initiatives. For making teachers ready for change, school principals should give information for change and benefits of change are mentioned by them, and uncertainty stems from change is reduced (Burke, 2008, Schweiger & Denisi, 1991). In the end, findings of the study concluded that when teachers develop trust for their school principal, their stress and uncertainty across change interventions are reduced which is the basis in the construction of change initiatives (Gomez & Rosen, 2001; Martin, 1998).

The findings of research indicated that change process at primary schools can be investigated under three stages: initiation, implementation and post-implementation. In initiation stage, participants of the study point out school principals and MONE as change initiators. In fact, school principals are considered as decision makers in schools as regards determining what to change in schools. However, teachers do not demand for change initiatives and they may resist on change practices at first. Therefore, school principals take teachers' thought and get them involved into decision making process of change interventions. Furthermore, factors like communication, participation and management of change process are essentials for successful implementation of change initiatives. For this sense, it is clear that participation and communication within an open environment contribute to progress of exploring ideas, encourage support for change and create a sense of shared influence. Understanding of change interventions (Glew, O'Leary-Kelly, Griffin & Van Fleet, 1995), participation to change process and communication are critical factors for effective

change process (Mento, Jones & Dirndorfer, 2010; Walker, Armenakis & Bernerth, 2007). Actually, communication during change process contributes to understanding of change profoundly and destroys resistance caused by uncertainty and confusion (Mento et al., 2010). Moreover, information sharing and communication facilitate change processes and decrease the feelings about uncertainty by influencing openness of individuals for change interventions (Chawla & Kelloway, 2004). After the implementation of change practices in primary schools even imposed by MONE or performed by school principals, satisfaction from the results of changes stands out from teachers, school principals, parents and students, and maintaining of implemented changes achieved through owning, following and controlling. These three stages are also compatible with Lewin's three steps of change process: unfreezing, changing and refreezing (1947). More specifically, school principals and MONE initiate change implementations in schools through emphasizing the need for change compelled by internal and external environment when the first step unfreezing is considered. In fact, disconfirmation and anxiety are eroded by providing information by school administrators. In the second step, change practices imposed by school principals or MONE are implemented to reach a desired state. In refreezing step, desired change is ensured and sustainability of change is maintained. On the other hand, the stages revealed in the study are also getting along well with the phases in Fullan's change model: initiation, implementation, continuation and outcome (Fullan, 1982, 2007). In initiation phase, a decision to adopt a change is taken by MONE or localized change initiatives. Then, an idea or set of activities influencing education directly or indirectly are put into the practice in implementation stage. Continuation phase in the model is achieved by owning change and presenting determinism for sustainability of change interventions.

The changes at primary schools can be also described by emphasizing the theoretical framework behind change process when Van de Ven and Poole's (1995) process theories of organizational development and change. Of the four typology of change, change interventions in primary schools depend on *teleological* and *evolutionary theory*. In essence, teleological theory stems from goal setting and strategic planning (Chakravarthy & Lorange, 1991). Actually, change practices are resulted from intentional decision to change driven from school principals and MONE. At this point, it is obvious that change initiatives are aroused from purposeful and adaptive acts (Van de Ven & Poole, 1995). The school principals or MONE determine the direction and details of change practices in school through setting goals and purposeful cooperation with teachers and students. Specifically, goals related to educational matters and school structure are formulated and then change practices are implemented and evaluated. This situation is clearly mentioned in strategic planning reports of primary schools. In fact, schools envision end state of the development before implementation of change practices, and goals are set explicitly. In that sense, schools establish their organizational mission statement with creating their vision, plan their strategies and list their goals. All these concepts are accepted as the applications of teleological theory (Burke, 2008). On the other side, teachers in the study referred students as an important internal factor of change by stating that student were changing in a continuous improvement. Moreover, principals stress that increased competition is one of the major external forces of change in schools. Emphasizing competition and changing environment clearly refer to evolutionary theory of change that is adopted in schools.

With the light of findings there may be some suggestions for schools and Ministry of National Education in order to get successful change implementations. Firstly, if change

project is initiated from top to down, ministries should inform both school principals and teachers working at primary schools concerning the benefits ,possible results and process of changes before initiating radical change implementations. In fact, knowledge about why of change and its moral purpose behind change implementation; e.g. improving society, should be given. The capacity of the schools should also be built through increasing the collective power in school by developing new knowledge, skill and competencies (Fullan, Cuttress & Kilcher, 2005). Besides, school principals' authority and responsibilities as change leaders should be checked out again for the implementation of localized change interventions at schools. In this way, authorities of school principals can be increased. In addition, it is obvious that teachers and students are suffered from change implementations utilized by the ministry. Therefore, the ministry should consider views of school principals, teachers, students and parents about implemented change practices, and necessary improvements and applications should be carried out. School principals also should participate teachers in change decisions, share information related to change and encourage teachers for change to eliminate negative attitudes towards change. Hence, coherence making should be fostered by the school principals for increasing change knowledge so that culture for learning and change is built Fullan, Cuttress & Kilcher, 2005).

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TIME PHASED MANPOWER MODEL FOR EDUCATION PLANNING IN AFGHANISTAN

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ABSTRACT

This work provides the education planner with an introduction into the use of a time phased linear programming manpower model as it pertains to teacher demands at the provincial and national level. We first explain model fundamentals and then propose the use of such a model to provide keen insights into potential futures regarding a state's education system. Then, we provide a case study that delves into the Afghanistan education system providing insights into teacher training capacity issues as well as potential disparities across genders and provinces. A modification of the model to provide sensitivity analysis regarding policy, assumptions, and uncertainty is also presented, which demonstrates the power of linear programming as a decision tool within the realm of complex policy analysis.

INTRODUCTION

The demand for qualified teachers is a first principal in the determination and following prescription of education policy through planning. Teacher management is a critical governance issue in fragile state contexts, and especially those in which the education system has been destroyed by years of conflict and instability (Kirk, 2008). The importance of teacher planning to a society is only reemphasized by the United Nations Millennium Goal #2 – "ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling" (United Nations, 2010, p.1). Teacher supply and demand manpower planning has been brought to the forefront given the continued and ever growing role of the international community in education development throughout the world. However, given natural challenges to teacher development such as an unqualified supply pool for teachers in many countries, competing national interests, security concerns such as in Afghanistan, societal implications, and disease concerns such as in Africa, it is of particular importance that education planners make the most of the planning and policy comparison tools available to them. Here we present a linear programming manpower model which was developed in accordance with many of the premises of education planning. We use this model to provide insight into potential future teacher demand and educational frictions in Afghanistan, but we assert this model structure is useful in numerous cases. Additionally, we explain the assumptions and potential weaknesses in the model as these matters are likely common. Included in this study is a brief overview of the mathematical modeling technique of linear programming to expose how such a model cannot only be insightful, but transparent, allowing the education planner and decision maker to understand the assumptions and limitations within the model.

TEACHER SUPPLY AND DEMAND WITHIN THE CONTEXT OF EDUCATION PLANNING

Across the literature, one of the more referenced definitions for education planning is given by Phillip Coombs [1], "[Education Planning is] the application of rational, systematic analysis to the process of educational development with the aim of making education more effective and efficient in response to the needs and goals of its students and societies" (Coombs, 1970, p.14). The purpose of manpower forecasting is to provide decision makers insight to ensure training and inventory focus on the areas needed (Cashbaugh et al., 2007). Bringing these two designations together as Reichardt does, we see

> The main purpose of a teacher supply and demand study should be to improve the education of all learners, by helping policymakers create targeted policies that ensure all learners are taught by high quality qualified teachers, all of the time. Understanding the actual extent of the need for qualified teachers is the first step in ensuring that there is a qualified teacher in every classroom" (Reichardt, 2003, p.2).

The supply of people does not immediately meet the demand for teachers. Qualified teachers and the processes which train these teachers are resource intensive. The allocation of resources to meet current needs given future requirements requires the "rational, systematic analysis" referred to by Coombs. Inarguably, this is a rather important part of any government's duty to its populace and should therefore be conducted deliberately and without bias. That being said, it would be interesting to know how many planners intentionally use proven mathematical models for educational manpower planning, and of those who do, how many education planners understand the implications and assumptions. A search of the current literature shows, although improvements have been made in the quantitative models of education focused on planners, much of the focus is on statistical and data analysis techniques and gains can still be made in forecast modeling.

This is by no means a new problem in the realm of education planning. In his 1970 article, Mathematical Programming Models in Education Planning (McNamara, 1971), James McNamara conducts a rather broad sweep of what is the beginning of a deliberate marriage between the management science of Operations Research and Education Planning. He focuses on the use of mathematical programming to support the design of education policy in the realms of curriculum selection, design of physical facilities, resource allocation, cost accounting, salary schedule analysis, and student population projections. He further classifies most educational planning models into the subsets of social demands approach which attempts to project individuals' demands for places in the educational system as opposed to society's demands for trained manpower and the manpower-requirement approach which ascertains future needs for manpower from projections of the growth of the economy and inputs of labor of various skills (McNamara, 1971). McNamara provides examples of such models such as Galloday who constructed a Macro dynamic linear programming model for education in Morocco (Golladay, 1968).

These models, which were computationally expensive at the time, can now be solved relatively easily on a typical personal computer. Additionally, the growth of the field of management science has brought many of these techniques to the forefront of analysis, proving they can provide a tremendous benefit to educational planners.

[1]Phillip Coombs was the first US Assistant Secretary of State for Education and the organizer of IIEP.

Johnstone (1974) conducted a comprehensive review of model development in educational planning which surpassed looking only at mathematical programming – one of his greater conclusions was:

> [regarding model development] the interest shown in models, however, is one sided. Most research has been carried on in research centers or in institutions of higher education; there is little evidence in the published literature to indicate that much is done in ministries or departments of Education where plans and policies are formulated (p.194)

We believe that there has not been enough done over the past 50 years to remedy this. Here we provide a tractable model and use of Operations Research to assist in the improvement of this breach. This study further provides an introduction to linear programming for an educational planner and follows it with a case study of Afghanistan using open source data.

LINEAR PROGRAMMING

Linear programming is a mathematical technique that maximizes (or minimizes) a linear function subject to a system of linear constraints. This linear function, together with the system of linear constraints, forms what is called the linear programming model (LP). The canonical form of an LP is shown below (Hillier & Lieberman, 2010):

$$
\begin{aligned}
&\text{Maximize} && c_1x_1 + c_2x_2 + \ldots + c_nx_n \\
&\text{Subject to} && a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n \le b_1 \\
& && a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n \le b_2 \\
& && \ldots \\
& && a_{m1}x_1 + a_{m2}x_2 + \ldots + a_{mn}x_n \le b_m \\
& && x_1 \ge 0,\ x_2 \ge 0,\ \ldots,\ x_n \ge 0
\end{aligned}
\qquad (1)
$$

Notice that the LP consists of (a) a linear function called the objective function that measures the relationship between a solution set of parameters and decision variables, (b) a set of linear inequalities or equations called functional constraints which define restrictions or limitations of available resources or required demand, and (c) nonnegativity restrictions for decision variables called nonnegativity constraints (Cook and Russel 1977). The linear programming model (1) can be written compactly as below:

$$
\begin{aligned}
&\text{Maximize} && \sum_{i=1}^{n} c_i x_i \\
&\text{Subject to} && \sum_{i=1}^{n} a_{ji} x_i \le b_j, \ \text{for } j = 1, \ldots, m \\
& && x_i \ge 0, \text{ for } i = 1, \ldots, n
\end{aligned}
\qquad (2)
$$

Here, the objective function has the goal of maximizing some combination of c_i and x_i, where c_i is a set of constants and x_i is a decision variable whose value is determined when the model is solved. Their values provide the answer which the model seeks to solve. For example, the optimal number of first grade teachers could be represented by x_1. The a_{ij}, c_j, and b_i are model parameters which are representative of data or model input – following the linear programming models (1) and (2), c_1 could represent the known salary of a first grade teacher.

A form of linear programming is that of network models. A lead principle in network models is that of balance of flow (or conservation of flow), which states that total flow into a location minus total flow out of a location equals the net demand at every predefine point. This often takes the canonical form:

$$\sum_i \sum_j x_{ij} - \sum_i \sum_j x_{ji} = b_k \tag{3}$$

where x_{ij} is the variable input flow from location i to location j and x_{ji} is the output flow from location j to location i, and b_k is the net demand. This is also referred to as a balance constraint as it assures that in-flows equal out flows for materials and products by one stage of production and consumed by others (Rardin, 1998). This model can then be expanded to create a time phased balanced constraint. Rardin provides a salient way to understand this time phased concept as shown below.

$$L_{t+1} = L_t + I_t \tag{4}$$

where L_t and L_{t+1} represents respectively starting level at time periods t and $t+1$, whereas I_t represents impacts of period t decisions. We can now see a common premise found in many manpower models – in that the number of personnel employed by an agency in the current year is dependent on those who were employed the previous year and impacted by policy decisions such as hires and releases as well as exogenous factors such as unplanned losses.

Balance of Flow Manpower modeling is a transparent and efficient way to provide key insights into the manpower requirements for teachers in a developing for educationally struggling country. Such modeling can easily account for training requirements, spatial implications, temporal needs, uncertainty, and cultural implications. These models run in relatively short times allowing iterative exploration and sensitivity analysis. In this work, we explain a mathematical model in terms meant for the education planner who might not have a background in linear programming, but as with any good planner or policy maker, feels he or she must understand a model if it is to be used to inform policy.

THE CONTEMPORARY PLANNING ENVIRONMENT

The recent international community's emphasis on education is made apparent in the United Nations Millennium Goals. Goal #2 is to ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling" (UNDP Afghanistan, 2011). In a recent article Thomas Friedman expounds upon two financial

commitments by the United States, one to Egypt for $1.3 Billion worth of tanks and fighter jets, and one for $13.5 million in scholarships for Lebanese youth to attend tertiary education. He states "The $13.5 million in full scholarships has already bought America so much more friendship and stability than the $1.3 billion in tanks and fighter jets ever will" (Friedman, 2012, p. A27). This drives the question, how can an investment order of magnitude less than another be more impacting? The answer lies in the utility of education.

Education has proven an important driver for economic growth, development, fertility management, lessening mortality, and improving health (Mackenbach et al., 2008)2008. Education provides stability, a basis for conflict sensitivity instruction, and a place for learning and remembrance; however, if education in conflict is not planned adequately it can provide space for the exacerbation of the frictions which are inherent to conflict (Smith, 2005).

It is apparent that in this globalized world, countries which have the capability to provide support in education should do so; not only because of education's moral importance, but also for righteous self interests. As is often the case in public utilities, human capital is the driving force behind the ability of a nation to provide education to its people – nowhere is this more evident than in fragile or developing states. It is these states with the limited capacity where acute planning is arguably more important than in developed countries where the societal capacity (i.e. trained people pool) can compensate for poor planning. But in many fragile and developing countries, human capacity is a precious resource – whether due to a lack of current capacity, security considerations, disease outbreaks, poverty, cultural frictions, or ethnic strife, there are circumstances which influence the teacher production pool, and these should be planned for and analyzed.

This dynamic environment provides complexities and challenges which require creative modeling to simulate. For example in a very recent publication, Marchant and Lautenbach show the importance of disaggregation in looking at teacher demand in South Africa as well as the importance of accounting for student teacher ratio goals and the implications regarding the quality of education. They also show that due to an aggregated look at the teacher supply in South Africa – many teacher training colleges (TTCs) which were later proved critical were closed (Marchant & Lautenbach, 2011). Often the integrated impacts in a system are lost when a myopic view is taken, while the converse is also true as intricacies are lost when studying the system in the aggregate. Here we show how a relatively simple linear program can be used to conduct analysis at a disaggregated provincial level to inform decisions regarding teacher training colleges in Afghanistan. We also demonstrate how sensitivity analysis can be used to provide prescriptive policy insights while accounting for uncertainty and potential interactions within the system.

A CASE STUDY: MODELING THE AFGHANISTAN EDUCATION SYSTEM

In this next section, we provide an example of a use of linear programming to explore the potential futures of the Afghan Education System. Over the previous three decades, torn from multiple wars and an intolerant governing regime, the education system in Afghanistan has been decimated. Only in the recent decade has there been a unified effort towards the improvement of education. This emphasis, regarding education, has provided benefit, but has also brought unexpected problems. There has been a seven fold increase in the demand for primary and secondary education with nearly seven million children enrolled in school today (Ministry of Education, 2011). Unfortunately, in a country with 27%

adult literacy, an ongoing war upon its soil, an opium trade as a primary gross domestic product, and an inefficient use of international aid, meeting the increasing demand for education is difficult at best (Sigsgaard, 2009). The Afghanistan Ministry of Education (MOE) has stated that the future of Afghanistan depends on the capacity of its people to improve their own lives, the well being of their communities, and the development of the nation.

As of 2012, there are 56 primary donors who have donated approximately $57 billion U.S. to Afghanistan (Margesson, 2009). The UN Coalition is dedicated to the security and infrastructure improvement of Afghanistan in order to ensure Afghan Government success. In 2014, with the anticipated withdrawal of coalition forces and a newly autonomous Afghan state, the future is uncertain. The purpose of the following case study was to use mathematical modeling to demonstrate potential outcomes and points of friction regarding the demand for teachers in Afghanistan, given the substantial forthcoming changes in the country.

This case study focuses on the capacity for teacher training in Afghanistan as it pertains to the growing demand for education. Although the current pool of teachers has a mixed training background (73% of teachers have not met the grade 14 graduate requirement (Ayobi, 2012), the Afghanistan Ministry of Education requires a two year teacher training college (TTC) after a potential teacher has passed the equivalent of 12th grade (Ministry of Education, 2011). Therefore, it is rather important to determine the number of future teachers required to enter the training base each year to support the increasing education demand. Of equal importance is discovering potential weaknesses in training capacity, and where these potential friction points exist. The issues cannot be remedied in the short run. Therefore, it is beneficial to use insights gained through modeling to inform policy decision.

The following modeling technique is based on a network flow mixed integer linear program which has been successfully applied to a wide range of problems such as school facility decision (Greenleaf & Harrison, 1987), transportation network (Current & Marsh 1993), generation expansion planning (Kim et al., 2011), energy management (Manfren, 2012), and so on. Our network flow integer program provides insight into potential weaknesses in the development of the future of teacher training.

We use Bombach's individual demand approach to education forecasting where the potential supply of educated manpower is derived from the present and the expected future individual demand for education. The projection is based on the rate of growth and the age composition of population, the present structure of the educational system, the number of students already enrolled, the prevailing graduation rates and trends, and the possible changes in the social structure of inflow into education (Bombach, 1965). Supporting this principle, the recent work of Marchant and Latenback explains "The growth in demand for teachers is determined by the growth in learner numbers and the post provisioning norm (PPN) or learner educator ratio (LER) that is applied institutionally. The demand for teacher replacement is determined by the in-service attrition rate, which can manifest as, for example, teachers retiring or seeking employment in other sectors" (Marchant & Lautenbach, 2011).

The proposed model determines the number of teachers that should be in training across Afghanistan by province, grade, gender, and time. The change in requirements by year is based on an increasing demand for education due to population increase, desire, near spontaneous development, a dynamic LER, and parity across gender and social class.

The model's primary premise is that of a balance of flow (Bombach, 1965). The number of teachers you can have in any given year is dependent on the number you had the previous year, the number that stopped teaching (quitters, deaths, retirees), the number that completed training, and the number that were reassigned within elementary, middle, and high school. Unfortunately, due to a fledgling current teacher base and limited teacher production capability, meeting the desired student teacher ratio in every province is infeasible. Therefore, we develop an integer program with elastic constraints to allow for a feasible solution set.

DATA AND ASSUMPTIONS

The MOE uses the Educational Management Information System (EMIS) system to collect a substantial amount of data regarding its teachers in order to provide transparency to the people of Afghanistan, as well as the international donor community. We feel this data, although not 100% accurate, provide enough truth to allow modeling. Due to the difficult situation in Afghanistan, we extended the current United Nations charter for 100% enrollment in primary education by 2015 to 2025. The intent of the model is to provide insight at 2020. We therefore use truncation to mitigate end effects regarding this relatively short horizon (Grinold, 1983). The UNESCO Institute for Statistics (UIS) projections provided an estimate of the number of additional teachers, or inflow, required to compensate for attrition rates in order to assess potential training needs. Therefore, based on the UIS data, three scenarios are based on different attrition rates: low (5%), medium (6.5%) and high (8%) (UNESCO, 2006). Due to disparity across Afghanistan, we assume the current annual salary for a teacher is $2000 US which we acknowledge as a gross approximation. Another assumption used in this analysis, which is easily permuted is that a 35 person classroom provides the optimal size, and is therefore the goal by 2025[2]. Although relaxed in some urban areas, gender separation is a requirement in much of the country and the MOE is vying for gender parity. We therefore assume no cross gender education (except in TTC). Teachers that attend the two year Teacher Training College in a province will teach in that same province (we relax this later during the sensitivity analysis). UN population estimates for 2025 were used (United Nations, 2011)[3]. A suitable mathematical technique is a linear extrapolation of the population based on the futures of the ages and the current population proportion across provinces (Mehta, 2004). This method provides values relatively close to the MOE's provided in the 2011 Ministry of Education Interim Plan.

For this model, the population growth rate is determined using the UN population forecast for Afghanistan each year and is assuming that 100% of primary aged school children and 80% of secondary aged school children will be enrolled by 2025. This assumption was proportionally decomposed across province, sub-age group, and gender. This provides a linear expectation for enrollment at each future year, accounting for the current education demand while anticipating the future demand.

[2]The current plan by the MOE is 35.6 person classrooms by 2015.

[3]This is an aggregate of all 34 provinces, so we used the ratio of the population by province in 2009 from the LandScan 2009 Global Population Database (The NATO standard for assessment in Afghanistan) and used linear forecasting to determine future enrollment based on the Enrollment Ratio Method, 'which is calculated on the basis of past data, and is extrapolated into the future by applying a suitable mathematical technique or a specific logic' (Mehta, 2004).

Model Explanation

The premise of the model is that of an employee hiring-training problem (Wagner, 1975). The Afghan Ministry of Education must hire, train, and graduate enough teachers from TTC each year to meet the growing demand of education in Afghanistan. Due to a severe shortage of female teachers and academically qualified individuals in some of the more rural areas, these challenges of parity must be accounted for. Below we go into detail regarding the objective function and some of the important constraints.

The objective function of the model is to minimize the total cost in dollars based on the annual salary of an Afghan teacher and the annual cost of training an Afghan teacher. Also, due to the infeasibility of meeting some of the constraints under variable conditions, elastic variables are used and the penalty is incorporated in the objective function. Although the objective function "drives" the model, we will soon show it is not the key premise to such a model.

$$\text{Minimize} \sum_{t}\sum_{d}\sum_{e}\sum_{g} c(X^{t}_{deg}) + \sum_{t}\sum_{d}\sum_{e}\sum_{g} f(Y^{t}_{deg}) + \sum_{t}\sum_{d} penalty(slack^{t}_{d}) \qquad (5)$$

Here, X^{t}_{deg} is the decision variable representing the number of employed teachers in year *t*, province *d*, of gender *e*, and grade *g*. Y^{t}_{deg} is the decision variable for the number of teachers in training across year t, province *d*, of gender *e*, and grade *g*. Also, in the objective function, we introduce a *penalty* value which is multiplied by $slack^{t}_{d}$. The *slack* variable is the repercussion of the elastic constraint. In the case of Afghanistan, as often the case, the current capacity (of the TTCs) cannot meet the demand in the out years. One issue with linear programming is its required feasibility. By introducing the *slack* we can provide some elasticity in our constraints; thus allowing the model to solve under penalty as opposed to solving infeasible.

To explain in more detail – we want to minimize the total of salary cost (*c*) and the training cost (*f*) each year while all provinces (*d)*, genders (*e)*, *and* grade levels (*g)*; plus the penalty for not meeting the required capacity (*slack)* in each district. These values are all indexed over annual time steps (*t)*. Table 1 shows an example of a notional solution set pertaining to the year 2012 in Province A, male teachers, across grades 1 through 5. The table includes the shortages in capacity – because in this model we only concern ourselves with shortages in districts annually (and not grade nor gender) the shortage is 2 for the entire province in the year 2012.

Table 1. Notional data example.

Year	Province	Gender	Grade	Shortage in Training Capacity (Slack)	Teachers	Teachers in Training
2012	A	Male	1	2	10	12
			2	2	12	14
			3	2	9	13
			4	2	13	14
			5	2	11	15

Table 1 also shows the number of teachers required in the province in that year as well as the number that need to be in training. Given the cost of salary of *c* and the cost of training *f*, for example the first row of the table would cost 10*c* + 12(*f*)+ *penalty*(2). The entire cost for the table equals *c*(10+12+9+13+11) + *f*(12+14+13+14+15) + *penalty*(2) – please note this would be done across gender for all years. The goal of the model is to minimize this cost. However, the objective function alone is of no value. Using only the objective function, the easiest way to minimize this cost would be to have zero teachers. However, this is not a feasible solution. We therefore use constraints to mold the problem. If the objective function drives the problem, the constraints steer the solution into the realm of feasibility. We propose a basic balance of flow model for both its simplicity and pragmatic solution. For this particular model, the balance we must maintain is that the number of teachers working in a current year must be equal to the number of teachers from the previous year plus any additional teacher training college graduates, adjusting for teacher attrition. Using mathematical notation this becomes:

$$\sum_{g} X^{t}_{deg} = \sum_{g} X^{t-1}_{deg} - \sum_{g} P^{t-1}_{deg} + \sum_{g} Y^{t-2}_{deg} \quad \forall\, t,d,e \tag{6}$$

Fundamentally, equation (6) states that the number of teachers employed in the current year for each province, gender, and grade must equal the number of teachers employed last year in each province, gender, and grade accounting for *P* – those that were lost due to attrition of various sorts, and adding in the second year cohort graduates from TTC. As the model solves for all years from 2012 to 2025, X^{t}_{deg} can be determined for the entire set of years. A snap shot of equation (6) for the year 2015 would be:

$$\sum_{g} X^{2015}_{deg} = \sum_{g} X^{2014}_{deg} - \sum_{g} P^{2014}_{deg} + \sum_{g} Y^{2013}_{deg} \quad \forall\, d,e \tag{6a}$$

That is, the number of teachers employed in 2015 is equal to the teachers employed in 2014 subtracting out the 2014 losses while adding in the graduating class of TTC students who began school in 2013. Using our previous chart as a starting point what we have is:

Table 2. Notional data including losses.

Year	Province	Gender	Grade	Teachers	Teachers in Training 2nd Year	Teachers in Training 1st Year	Losses
2012	A	Male	1	10	12	12	3
			2	12	14	14	4
			3	9	11	13	3
			4	13	10	14	2
			5	11	9	15	1

In order to meet the constraint of equation (6) we see that in 2013 the number of 1st grade male teachers in province A would be 19 (i.e., 10+12-3). Note that these values are all variables which the model itself solves for in order to minimize the overall cost. For this particular model, the requirement to keep working teachers in line with their previously assigned grade seemed over restrictive. We therefore reduce this constraint allowing teachers to move across grades within their subset of primary, secondary, or post secondary education. The resultant requirement for primary school (grades 1-4) teachers in the year 2013 would then be 79 (i.e., 10+12+9+13+12 +14+11+10-3-4-3-2). Relaxation of a constraint creates a larger solution space. For this particular model, the balance constraint (6), based on research, proved overly restrictive. The balance equation as presented states that first grade teacher in year *t* will remain as first grade teacher in year *t+1*. By relaxing this constraint from grade to education level, the model is permitted to shift teachers within primary, secondary, and post secondary education levels to meet requirements.

The last constraint we explain in detail in this paper is the capacity constraint of the TTCs, which represents how many teacher candidate students can accommodate a teacher training college each year. It turns out that this is a dominant limiting factor in this model. In constraint (7) we introduce k_d which represents the TTC capacity for the respective province. Another concept introduced in constraint (7) is that of ordinality. The function to the right of the inequality notation is similar to the equation used to determine the impacts of compound interest. Since the main difference is because we are interested in knowing each year's required TTC capacity, we raise the growth formula by the index of each year. For example, as the model begins in 2011, the set {2011, 2012, 2013} has ordinal values {1, 2, 3}. This allows the TTC capacity to grow by 10% compounded annually. This is a bit lower than the MOE goal for the next three years, but is an adequate fit for the out years. Additionally, we use a slack variable to account for a lack of capacity, providing elasticity and allowing the model to handle infeasibility. That is, this slack variable accounts for the additional required capacity in the province's training base. This capacity corresponds to the required number of training positions in TTC for the respective province beyond that of current or forecasted capacity. This constraint can as easily model supply of qualified personnel for teachers as it does capacity of the training ground.

$$\sum_{e}\sum_{g} Y_{deg}^{t} + \sum_{e}\sum_{g} Y_{deg}^{t-1} \le k_d (1+0.1)^{ordinality(t)} + slack_d^t \quad \forall\, t, d \tag{7}$$

Additionally, we account for the learner educator ratio (LER) as emphasized by Marchant and Lautenbach (2011). This constraint established a goal of 35 students to one teacher by 2025. As many provinces are far from meeting this goal, we established a linear glide path beginning in 2012 with the current provincial LER, thus establishing annual goals (which the model must meet) along the path to 2025. Once again, we can use the concept of ordinality to help establish the slope of the linear path. We will later discuss the trouble in making the gross assumption of linearity. Another important constraint is that of non negativity. Because it is infeasible to have negative teachers in training or in classrooms, it is important to define such constraints to prevent the model from "cheating" and exploiting potential solutions sets with negative variables.

RESULTS AND DISCUSSION

Based on current production estimates, reaching the goal of having at least 35 students in each classroom in the next thirteen years at the prescribed growth rate is infeasible in eleven of the provinces. However, the model provides enlightening insights into the requirements and information on why the infeasibility exists. With a goal of converging from current classroom sizes to 35-student classrooms by 2025, and a growth rate of teacher training capacity of 10% compounded annually with a loss of at least 6.5% for each gender respectively, there is a requirement to hire and train approximately 212,000 male teachers and 223,000 female teachers for a total of about 435,000 teachers over the next 12 years. On the average, this would cost approximately 500 million U.S. dollars a year in teachers' salaries alone (approximately 9% of Afghanistan's 2009 total international aid (Poole, 2011) and 30% of its 2010 annual revenues (CIA, 2012). In order to grow the teaching force to the required size while accounting for planned losses, the current production based on the 10% growth will fall short by approximately 125,000 teachers in 11 of 34 provinces and Kabul City. Table 3 shows the breakdown of the Afghan provinces which will be short of teachers in at least one year from 2013 to 2023.

Table 3. Two groups of Afghan provinces lacking required capacity.

No Additional Capacity Required	Additional Capacity Required
Badakhshan, Baghlan, Balkh, Bamyan, Farah, Faryab, Ghazni, Ghor, Hirat, Jawzjan, Kaprisa, Khost, Kunar, Kunduz, Laghman, Nangahar, Nimroz, Nuristan, Panjshir, Parwan, Samangan, Takhar, Wardak	Daikundi, Hilmand, Herat, Badghis, Kabul City, Kabul, Kandahar, Paktia, Paktika, SariPul, Uruzgan, Zabul

Figure 1 shows the required employment of teachers across the education levels to meet the 2025 education requirements in a stacked bar chart, while overlying the breakdown of this expectation by gender. We see that the initial focus will be amongst primary school teachers as the younger student population continues to grow at newly found rates; however, by 2020, we begin to see an increased growth of demands for secondary education, and by 2023 the upper secondary education growth rate becomes exceptional, overcoming that of the primary grades.

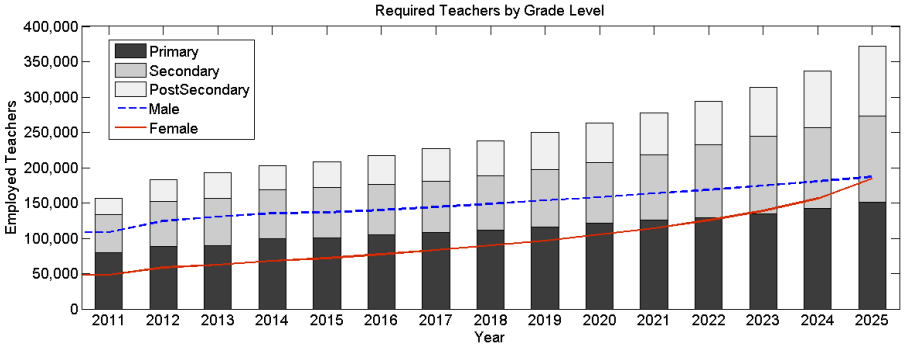

Figure 1. Required Teachers by Grade Level & Gender in Afghanistan to meet 35:1 LER in 2025

As of 2010, 245 out of 412 urban and rural districts did not have a single qualified female teacher – illustrating the gender disparity regarding teachers (Ayobi, 2012). However, the population of students is growing to parity amongst genders (Ministry of Education, 2011). We found that in the year 2020, the rate at which the model graduates and employs female teachers increases substantially above that of the men. The lines in Figure 2 show the required convergence assuming that females must be taught by females. This is both based on the requirement for female teachers to teach females and the growing population of female students. Although this growth is infeasible due to capacity restrictions, it is a basis to determine the required growth in female teachers. It is likely infeasible for all provinces to provide this many 12th grade graduate females by 2025. Based on this graph, Afghanistan can expect to need a tremendous number of female teachers with an emphasis of growth on secondary and post secondary education in the future. Although beyond the scope of this research, this lends itself to implications regarding tertiary education demands as well.

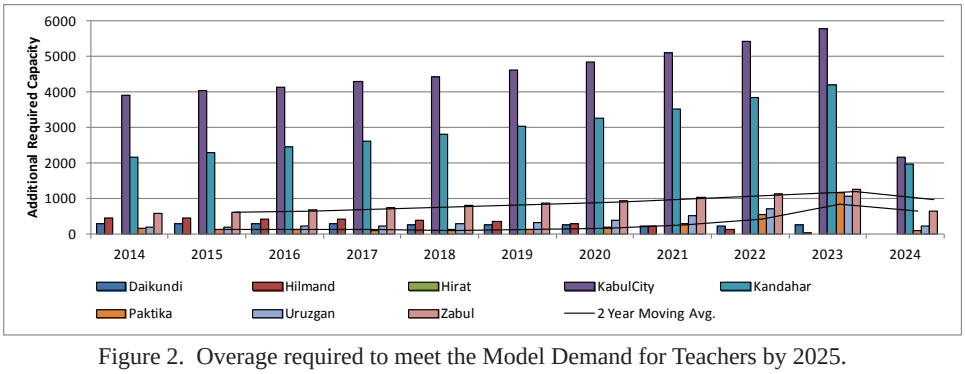

Figure 2. Overage required to meet the Model Demand for Teachers by 2025.

Referring back to Table 3, it became of interest to use the model to conduct further analysis into the provinces which lack the required capacity to meet the demand. Figure 2 shows the eight provinces with the greatest shortage in TTC capacity. Immediately, we notice that Kandahar, Zabul, and Kabul are consistently suffering from lack of capacity. Of note, most of the distressed provinces display a rather stable growth in the required

training capacity past 2014 with the exception of Paktika. This is brought to attention in Figure 2 by displaying a two year moving average filter across Zabul and Paktika. Zabul, which is similar to the other provinces, display the smooth trend which is almost linear in nature. However, we see a sharp growth in Paktika during the year 2022. Further investigation reveals that Paktika's overage and required growth in the 2022 to 2023 time frame is dependent on the current and excessively high female learner to educator ratio. Because of this, as the model moves to close this gap over the 12 year time span, it is at a 70:1 ratio in 2024 and moves to a 35:1 in 2025. Therefore, it must double the number of female teachers in the province. This highlights an important point – the provinces are different, and it is going to take individual policies to grow the teacher population accordingly. In the case of Paktika, a linear growth rate is not preferred, and a greater rate of growth up front would be beneficial. Clearly, when modeling at a rather low resolution, assumptions can be very impactful and must be explained to the decision maker.

Because the model accounts for region and gender, we are able to glean insights into the gender disparity in those provinces that display some of the greatest difficulty in meeting the requirements. For example, nine provinces display substantial disparity in the hiring of females in the early years to compensate for their current disproportion. However, in the mid years, the model reaches equilibrium in hiring only to surge growth regarding female teachers in 2022. This correlates to what was seen in Figure 1, regarding a significant growth of upper secondary demand. For example, in 2023, the model hires approximately 2,700 female teachers for upper secondary in Nangahar. This accounts for 58% of all hires for Nangahar in 2023. Although this can be gleaned by conducting data analysis, we feel this is a successful instance where optimization can provide insights parsimoniously. The bottom line seems glaringly obvious, there is a lack of capacity to which there is likely no simple answer, and this can cause disparity in education throughout the country unless other techniques for training and hiring teachers are used.

SENSITIVITY ANALYSIS

One benefit of using a somewhat simple model which solves quickly is its flexibility allowing further exploration of the problem. In conducting sensitivity analysis, we delve into both the model's susceptibility to the assumptions as well as its ability to explore policy implications. For example, the infeasibility of meeting demand requirements for teachers in almost half of the provinces in Afghanistan resulted in a requirement for further investigation into the modeling assumptions as well as potential changes in the teacher training system which might provide significant impacts to the production of teachers. This sensitivity analysis includes investigating the effects of changing TTC from two years to one year, relaxing the geographic restrictions on teacher training to hiring, and stochastically varying the assumptions regarding teacher losses.

As previously mentioned, an important aspect of the Afghan educational policy is the actual teacher training program. An alternative policy option, if human capacity and infrastructure cannot support additional TTC capacity, is the trade of time for training seats. We, therefore, felt it worthwhile to investigate the impacts if the two year TTC mandate is changed to a one year program. Not surprisingly, the results show a dramatic impact in teacher training growth. A one year program allows 30 of the 34 provinces to provide enough teachers to meet the demand. Kabul City, Kandahar, Uruzgan, and Zabul still fall well short of the required demand when using the one year program. Not only does the

number of provinces which do not meet the capacity substantially decrease, but we also see a substantial decrease (about 50%) in the overage required to grow the required teacher force across the nation. Time can be traded for capacity, and this trade can be of great assistance. What is surprising with this excursion is that the one year program will allow Helmand, one of the more notorious provinces, to maintain the required field of teachers. Although there are a limited number of people qualified to attend TTC, it is possible that this course of action is viable to support the immediate growth needed throughout Afghanistan or at least be of a greater assistance in the selected provinces.

The current model is limited in that if a teacher candidate attends TTC in a province, he or she must teach in that same province. Although there are national incentive programs to encourage the dispersion of teachers, it appears that this is the current state in Afghanistan. However, as security in the country improves, freedom of movement should follow (Dressler, 2011), and we should expect teachers to move across provinces. The resulting set of excursions relaxes the geographic constraint from provincial to regional using the NATO regional command areas. This was used under the assumption that NATO had conducted research into the geographic regions of the country and the resultant spatially based regional commands are accurate depictions of potential state relations (US Department of Defense, 2011). This relaxation is visually depicted in Figure 3 which shows all 34 Afghan provinces which was the original constraint. The color coding on the map aggregates the provinces into five grouping.

Figure 3. NATO Afghanistan Regional Commands (Source: ISAF, 2012).

By allowing the transfer of teachers from TTC to any provinces within the respective region, we found the provincial constraint rather binding, and its relaxation is effective. The relaxed model results in only seven of the provinces failing to meet the constraint

versus the 11 from earlier. We also found that the number of teachers required decreases by 33% across the entire country. Of importance are the continued troubles in Kandahar and Helmand provinces. Not surprisingly, we found that the South, Southwest, and West Regional Commands cannot meet the required demand. This is a common trend and is a dangerous disparity within Afghanistan. The rural areas do not have the capability to produce the required number of teachers. Notably, these are the least educated regions with much of the instability. Incentives to travel and the freedom of teachers being trained and working in different provinces do provide significant improvement. However, it still will not completely solve the disparity in the rural parts of Afghanistan – some of which are of the greatest concern for the country's stability and security. Because this is initial research for a large scale simulation, it is beyond the scope to determine the exact provinces that should be supportive of interprovincial blending amongst teachers, but clearly, it pays tremendous benefits.

Clearly, the futures regarding education in Afghanistan exhibit intrinsically non-deterministic behavior. Therefore, we created a probabilistic version of the model to attempt to account for uncertainty and simulate heightened disruption or retention success across provinces, genders, and time. This was done using a random normal distribution to determine teacher losses. The purpose of the analysis was to determine potential interesting points of friction and the likeliness of friction within a province. Using a normal distribution with a mean of 6.5% losses annually, and the 2.5 and 97.5 percentiles being approximately 5% and 8%, respectively, we ran 100 repetitions – each with a different annual rate of teacher loss. The results showed that the system is not overly sensitive to teacher retention, yet the changes in teacher retention are not without influence. No new provinces are added to the initial set of provinces lacking required capacity. However, when losses are at the lower end of the spectrum, Paktia and SariPul fall off the list of provinces with inadequate training capacities (28% and 38% of the respective runs). We also found Bagdhis and Daikundi to be the provinces most sensitive to teacher retention with differences of 28% and 20% in the maximum and minimum capacity requirement. It appears that there is something to be gained by a successful teacher retention program. Table 4 summarizes the results of the stochastic runs for the four most influenced provinces for the years 2012, 2013 and 2023 as the other years display nominal requirements.

Table 4. Results of 100 excursions accounting for uncertainty.

Province	2013			2014			2023		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Badghis	67	110	157	0	14	42	345	385	430
Dakundi	298	393	459	117	167	197	213	297	377
Paktia	0	0	0	0	0	0	0	81	200
SariPul	0	30	92	0	0	0	0	0	0

These four provinces are close to meeting the required capacity due to changing retention rates. According to the results, SariPul is under capacity by nearly 100 teachers in 2013 when retention is poor, but when retention is high, it is capable of meeting the demand. Badghis displays similar results in 2013 and is rather sensitive to retention potentials. Further stochastic exploration can provide significant insights regarding exogenous circumstances such as security and funding.

CONCLUSIONS

This paper presents a time phased manpower linear programming model as a decision tool which should be exploited by educational planners. The intent was to not only provide insights into a large, messy problem which has the international community's attention, but to clarify and emphasize linear programming as it pertains to manpower planning within the educational planning community. The Afghanistan case study was done with minimum manpower and using open source data which can be found on the Afghanistan Ministry of Education Website. The model employed a mixed integer linear programming premised on the balance of flow to show provincial difficulties in meeting the demand for the quickly growing Afghan education system. Simultaneously, using elastic constraints, stochastic optimization, and a researched understanding of the problem provides insightful futures in analysis regarding a rather unknown environment. We have been able to isolate those provinces in Afghanistan which are critically short either teachers or training capacity and clearly demonstrate the severity. Additionally, the techniques provide insights into potential solutions and their impacts, shortening the requirement for TTC, relaxing geographic constraints regarding the relationship between TTC and actual employment, or ensuring the adequate retention of teachers. Although we provide a rather limited model in this study, the growth of such a model is only limited by the creativity of the educational planner and his or her understanding of management science. The appropriate marriage of the Operations Research techniques and the education planning can irrefutably result in improved courses of actions and inferences which our policy makers require in complex and resource-constrained environments.

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Acknowledgments

The support of the Afghan Ministry of Education and NATO Training Mission Afghanistan is gratefully acknowledged. The authors would also like to thank USAID Afghanistan and the U.S. Army analysts for many fruitful discussions and helpful comments during the course of this research.

University Planning: A Conceptual Challenge

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ABSTRACT

Most authorities on educational planning and change recognize that each situation is somewhat unique and that in complex organizations, like universities, a blend of approaches is necessary. Following the premise of the need for universities to approach planning from multiple perspectives, the purpose of this paper is to briefly explore the unique nature of universities and how this helps to define the considerations that must be taken into account when deciding which planning approaches should be used.

To accomplish this purpose, two primary frameworks are blended: Birnbaum's classic text on the characteristics of universities and Bolman and Deal's four frames for analyzing organizations (structural, human resource, political, and cultural). Against this backdrop, various approaches to educational planning are examined, e.g., incremental, bounded rational, comprehensive rational, mixed scanning, and developmental, to discern the situations and conditions under which they are appropriate for university planning. The overall conclusion is that due to the complexity of university characteristics and the need to examine the university's needs and conditions through each of the four frames, university planners must be well versed in all approaches in order to select the one(s) most appropriate for a particular planning endeavor.

INTRODUCTION

Some authors, especially those whose work is based on the strategic planning model (Bryson, 2011; Cook, 1990), seem to advocate that their approach, with minor modifications, is applicable almost universally. However, most authorities on educational planning and change recognize that each situation is somewhat unique and that in complex organizations, like universities, a blend of approaches is necessary (Kezar, 2001). Following the premise of the need for universities to approach planning from multiple perspectives, the purpose of this paper is to briefly explore the unique nature of universities and how this helps to define the considerations that must be taken into account when deciding which planning approaches should be used.

CHARACTERISTICS OF UNIVERSITIES

Birnbaum's (1991), *How Colleges Work: The Cybernetics of Academic Organizations and Leadership*, is generally recognized as the classic test defining the characteristics of universities. In that text, Birnbaum discussed both characteristics of universities in general and how universities each have their own unique characteristics. Birnbaum conceptualized universities through the general systems model and cautioned that their characteristics should not be considered individually, but rather as they interact to form the identity of that university. Various of Birnbaum's characteristics are examined in this paper in an effort to discern their implications for university planning.

Framing Planning

Just as Birnbaum's text is considered the classic work on the characteristics of universities, Bolman and Deal's (2008) text is the most cited regarding lenses for analyzing educational organizations. These authors advocated examining organizations through four *frames*: structural, human resource, political, and cultural. These were derived, respectively: from the work of rational systems theorists, who focused on organizational goals, roles, technologies, and structures; from the work of human resource theorists, who examined the fit between people and the organization; from the work of political theorists, who looked at issues of power, conflict, and the distribution of scarce resources; and from the work of symbolic theorists, who focused on the organizational culture. Bolman and Deal advocated that all organizational analyses, including educational planning, should consider all four frames in deciding a course of action. Figure 1 illustrates the relationship between Birnbaum's characteristics of universities and Bolman and Deal's four frames. It is through this combined framework that the conceptual challenges of university planning will be examined.

UNIVERSITY PLANNING

Change occurs in universities in two major ways, planned and unplanned; this discussion is delimited to planned change. As Wheatley (1999) noted, all organizations move toward chaos in ways they do not fully understand, one form of evolutionary change. Only when the threat of chaos becomes compelling do most organizations leave their preferred comfort state of homeostasis (Burke, 2010; Weick, 2000, 2009) and re-organize – which may include planned change. There are two major forms of change: teleological and evolutionary (Kezar, 2001). Teleological change refers to sporadic, episodic planned change, whereas evolutionary change is adaptive, on-going change, where distinct planning episodes are less detectable.

Planning Approaches for the Two Forms of Change

Certain planning approaches lend well to teleological change. Prime among these are the *comprehensive rational* approach (Benveniste, 1991; Brieve, Johnston, & Young, 1958; Kaufman, 1972; Sergiovanni, Burlingame, Coombs, & Thurston, 1980; Simon, 1955, 1957) and the *bounded rational* approach (March & Simon, 1959; Simon, 1982; 1997). Within these, a popular planning model for universities is the *strategic planning* model (Beach & Lindahl, 2004; Bryson, 2011; Cook, 1990; Mintzberg, 1994). All call for the discernment of goals and the selection of an optimal or perhaps a *satisficing* (March & Simon), alternative solution as to how to achieve those goals. The difference between comprehensive and bounded rationalism is that in the comprehensive approach, planners strive to fully understand the environment and the university and seek to identify, and select from, a maximum variety of solutions. The bounded rational approach assumes that the university does not have sufficient time, resources, or ability to conduct a truly comprehensive planning process and that it is not possible to know with certainty the consequences of selecting each alternative. Instead, the planning process focuses on a more limited set of core issues, conditions, and alternatives that lie within the realm of feasibility and satisfice by electing a reasonably effective plan rather than holding out for an optimal plan.

Structural Frame	Human Resource Frame
Interdependent Organizations	Employee Commitment and Tenure
Relatively Independent of the Environment Goal Ambiguity	Cosmopolitans and Locals Highly Educated Professional Staff, Less Educated Support Staff
Loosely Coupled System	
Organized Anarchical Decision Making	
Paucity and Inflexibility of Resources	
Clarity of Vision and Mission	
Political Frame	**Cultural Frame**
Institutional Status, Image, and Success Uncertainty and Conflict in Governance Roles	Unique Culture of the Academy Low Accountability
Multiple Power and Authority Structures	Values Driven
Shared Governance	Professor versus Administrator Values

Figure 1. Conceptual framework, based on the work of Bolman and Deal, and Birnbaum.

Other planning approaches lend themselves to evolutionary change. Prime among these are the *incremental planning* approach (Lindblom, 1959) and the *developmental,* or *goal-free planning* approach (Clark, 1981; Clark, Lotto, & Astuto, 1989; Senge, 1990). The incremental approach uses a relatively limited amount of information in identifying a goal and calls for ongoing, small advances toward that goal. It offers the advantage of calling for individuals to make only relatively minor, but ongoing, changes in behaviors and values.

A related, but distinct, planning approach, developmental or goal-free planning, is also well suited to evolutionary change. In this approach, planners identify directions, or thrusts, in which they would like the university to move. These are broader and less specific than traditional goals. Then, the individuals within the organization are challenged and guided to determine how they, personally or in units, can help the university move in the agreed-upon direction. For example, if a university determined that it wants to increase undergraduate student retention, how can faculty members contribute to that? How can the Registrar? How can financial aid conselors? How can residence hall staff? Each contributes in their own unique way.

Etzioni (1967) recognized that organizations need to have, and employ, a varied repertoire of planning approaches at any given time. There are needs that require teleological change, whereas others are better served through evolutionary change. Therefore, Etzioni introduced the *mixed scanning* approach to planning. In this approach, evolutionary change would be addressed by incremental planning, while at the same time teleological changes would be addressed through a rational planning approach, comprehensive or bounded.

If most university faculty and administrators were asked what type of planning occurs on their campus, the overwhelming reply would be *strategic planning*, a form of teleological planning. However, this would likely be deceiving. Faculty and administrators generally know about the university's strategic plan because it has been given extensive public recognition, is prominent on the university's web site, and is used to satisfy accrediting agency requirements. Departments and administrative offices are often required to develop similar teleological plans that link to the university strategic plan. Similarly, if the university plans a major expansion of its facilities, a similar teleological plan is developed and disseminated.

However, most university faculty and administrators are unaware of the other major approaches to educational planning and of their prevalence on university campuses. Universities definitely take a mixed scanning approach to their planning. In addition to teleological strategic and facilities plans, budgets are largely planned incrementally, as are staffing plans. Adding an estimated inflationary percentage to budgets for utilities, supplies, health care insurance, etc. is by far the most common practice among universities; very few use more teleological budget planning processes like zero-based budgeting.

Moreover, relatively few faculty and administrators are acquainted with evolutionary planning approaches such as developmental or goal-free planning, yet this is the most common form of planning at the department or program level. Programs and departments form shared visions and missions but seldom dictate what each faculty member must do to contribute to their attainment. Faculty have, and exercise, considerable freedom in determining how (and even to what extent once they have become tenured) to best contribute to the vision and mission of the program or department.

The purpose of this article is to explore the complexity of university planning processes, examine some of the variables that help to determine which planning process(es) may be most appropriate under specific circumstances, and to counterbalance the myth that strategic planning is universally accepted as *best practice*.

UNIVERSITY PLANNING VIEWED THROUGH THE STRUCTURAL FRAME

In looking at university planning from the structural frame, certain university characteristics assume key roles. First is the fact that universities are interdependent organizations. This forces the planner to look beyond the university to those other organizations in its environment that directly or indirectly shape what happens within the university. For example, what are the standards of the accrediting agencies that govern the university or specific programs within it? What are the governmental regulations that determine what the university must or cannot do? What are the standards of the various professional organizations that faculty members belong to in their respective disciplines? Such an analysis requires a teleological form of planning.

In regard to the general characteristic of universities being relatively independent of the environment (Birnbaum, 1991), planners must take careful measure of the extent to

which this is true of their university. For many public universities, this is indeed the case. Surely, shifts in public demand for specific programs may occasion the development of new programs and the possible decline of others, but this is essentially adaptive, first-order change (Argyris, 1994) and requires only minor teleological planning. However, other universities may be far more dependent on the environment, e.g., on-line, for-profit universities that survive through competitive, aggressive matching of resources and offerings to current demands.

Goal ambiguity is another characteristic of university culture. Birnbaum (1991, p. 155) cited the example of the goal of preparing students who are "liberally educated" and noted the wide variations of definitions of what this means, making it difficult, if not impossible, to establish firm targets around this goal. Birnbaum added that university goals often arise from actions rather than actions arising from planned goals. Goals are more a loose collection of ideas than firm targets. Again, this makes teleological planning difficult and lends itself more to evolutionary planning.

Birnbaum (1991) defined universities as loosely coupled systems (Morgan, 2006; Weick, 2000, 2009). However, they may more accurately be described as having simultaneous loose-tight properties (Peters & Waterman, 1982). Loosely coupled systems are largely uncoordinated and have high degrees of specialization within their units, whereas tightly coupled systems are far more centralized and less differentiated. Organizations with simultaneous loose-tight properties combine these two modes of operation. For example, the administrative side of most universities tends to be far tighter than the loosely coupled academic side. On the administrative side, there tends to be a high degree of centralized, bureaucratic control. Among academic units, there is often very limited communication or control, even within the same department or college. This dichotomy requires careful attention on the part of university planners. It is much easier to accomplish evolutionary change in the loosely coupled academic side of the university, as one program might elect to change as its national standards change, yet this would not require any changes in neighboring units. Because of the tightly coupled systems of the administrative side of universities, planning must be more teleological, as the implications of planned change must be considered for all units and processes.

Birnbaum (1991) discussed university decision making as an organized anarchy, in which instructors decide what to teach, students decide what to learn, and legislators and donors decide what to support. Neither coordination nor control are exercised and resources are allocated without specific reference to goals (p. 153). Birnbaum further characterized universities as having unclear goals, unclear technology (e.g., Why are some lectures effective and others not? Is small group work more effective than lectures or laboratory activities? In which subjects?), and fluid participation (e.g., committee membership changing or partial attendance at meetings). These characteristics clearly favor evolutionary planning processes, as all would mitigate against the success of teleological processes.

A further characteristic attributed to universities is a paucity and an inflexibility of resources. The personnel component of universities represents a huge, immutable portion of their usually meager budgets. This, along with fixed costs such as utilities, leaves very little discretionary funding available for new projects, a factor that suggests that evolutionary planning will have a better chance of success than its teleological counterpart, for teleological planning tends to require greater up-front funding.

Closely aligned to this characteristic is Birnbaum's (1991) characterization of

universities as engaging in organized anarchical decision-making, which has also been referred to as a garbage can model of decision making (Cohen & March, 1974; Cohen, March, & Olsen, 1972). This comes about because of ambiguity in universities, ambiguity of power and authority (Kezar, 2001). Planners must discern whether academic units have sufficient power and authority to implement planned changes or whether those changes require external authority, e.g., the Provost, the Board, the state regulatory body, or the regional accrediting agency. Beyond that, who has the power and authority to fund the planned changes?

Within the structural frame, the vision and mission of the university is the final, and perhaps most important, characteristic that planners must consider. Most teleological planning models begin the process by comparing the changes under consideration with the university's vision and mission. Unless there is strong congruity, those alternatives that do not align well are immediately dropped from consideration. Even in more developmental or adaptive planning models, universities are not likely to evolve in directions contrary to the mission and vision of the university. However, although virtually all universities have published vision and mission statements, many are so formulaic as to be meaningless. Certainly, not all employees of a university may share the same vision or mission, regardless of what is published. For example, this author works at an Historically Black University in the Southeast. Until the past several decades, its mission and vision were fairly well clear and shared by all. It provided education to bright Black students who were denied access to predominately White universities. Its primary focus was on teacher education, as it was consistently one of the top providers of Black educators in the nation. Recently, however, bright Black students are welcomed, and often given scholarships, in White universities. Consequently, the pool of highly qualified Black students is dispersed, perhaps causing entrance standards at this university to be lower in an effort to maintain enrollment. This Historically Black University is under pressure to attract both White and Black students; to do this, it implemented a series of highly visible, highly attractive graduate programs in areas like forensics, micro-biology, orthotics, and physical and occupational therapy, shifting some of the focus from teacher preparation. Needless to say, this has wreaked havoc on shared understanding of mission and vision.

UNIVERSITY PLANNING VIEWED THROUGH THE HUMAN RESOURCE FRAME

Universities are somewhat unusual organizations because of the tenure process. Once tenured, usually after six years in higher education, faculty members have tremendous job security. Anything short of committing an egregious act or the complete shutdown of a program, tenured faculty members have the expectation of perpetual employment in that university, if they so choose. This characteristic favors evolutionary planning, as the university does not have great influence to force tenured faculty members into major teleological changes.

Birnbaum (1991) noted that there are two major mindsets among university faculty – *cosmopolitans* and *locals* (Gouldner, 1957). Cosmopolitans tend to use their wider profession as their primary frame of reference, whereas locals tend to view their specific university as their frame of reference. In terms of planning, locals tend to resist change more ardently, suggesting a need for evolutionary planning. Cosmopolitans, on the other

hand, are more open to sweeping new ideas from the wider profession and might readily see the need for teleological planning and deeper changes. However, as both types co-exist within most universities, this increases the dilemma of selecting a planning approach.

Similarly, a characteristic of universities is the noted differences in education levels between faculty, most of whom have terminal degrees in their field, and support staff, who typically have lower education levels (and lower salaries). This schism suggests that developmental or goal-free planning may be appropriate, as each individual contributes in his or her own way rather than having formal goals set for the university as a whole, as would be more the case in teleological planning.

UNIVERSITY PLANNING VIEWED THROUGH THE POLITICAL FRAME

Institutional status is a key characteristic of universities, and one that must be considered in planning. There are a multitude of factors that influence status, image, and success. Is the institution a flagship, Research Intensive university? If it is a small liberal arts university, has it attained a reputation for exclusivity and excellence? Is it a *directional* university, meaning a regional state university whose status is inferior to the state's flagship(s)? Is the university a major recipient of federal grants? Does the university have a law school or medical schools? The higher status and more success a university has, the more likely it can attempt large-scale teleological changes, e.g., allowing the entire world free access to all on-line courses and materials, as is happening at some of America's premier universities.

Birnbaum (1991) characterized universities as having uncertainty and conflict in governance roles and multiple power and authority structures. At most universities, the faculty feel that they participate in collective governance, especially over academic issues. However, most major academic issues must receive administrative approval, e.g., the Provost, the President, or even the Board. Faculty may plan and approve curricular initiatives, but funding rests in hands of administrators. In unionized universities, governance may be highly conflictive and very much governed by the signed union contract. Determining where governance truly lies on each issue is a crucial, early step in any university planning process, but more so in teleological processes.

Similarly, shared governance is a characteristic somewhat unique to universities. Virtually all universities have a Faculty Senate, where shared governance is institutionalized. Many Faculty Senates are quite powerful, including the ability to influence the removal of a President through votes of no confidence. Others are far less effective due to a powerful central administration or board. At college, department, and program levels, shared governance is a norm at most universities, although at some universities it is only partial, as power differentials among faculty members (e.g., prestige, rank, and tenure) come into prominent play. The more shared governance, the more likely developmental or goal-free planning can lead to the desired ends. Less shared governance and more hierarchical governance structures lend themselves more to teleological planning.

UNIVERSITY PLANNING VIEWED THROUGH THE CULTURAL FRAME

The final frame of Bolman and Deal's (2008) model is the cultural frame. As the culture of universities often differs significantly from other organizations, it is important to examine those characteristics of universities identified by Birnbaum (1991) that relate to university culture.

The first of these characteristics is the overall culture of the academy; once again, however, it is essential to understand that although universities may share some general cultural similarities, each has a unique culture that must be understood for effective planning to occur. Some universities have very strong cultures, yet others have weaker, more fragmented cultures. Birnbaum (1991) noted that universities exist within a hierarchical system. Consequently, their cultures are affected by the cultures of the national education system, the culture of the academic profession, the cultures of the various disciplines, the cultures of the peer system of comparable institutions, etc. (p. 73). Each university has its own myths, stories, legends, and symbols (p. 74). All must be taken into account, especially in teleological planning. In evolutionary planning, changes are planned to be incremental or developmental; consequently, it is less likely that they will pose a serious threat to the university culture.

One general aspect of university culture is that they have low accountability. For many majors, there are no state or national examinations that would allow comparisons across universities. Graduation rates are generally only posted for athletes. Because entrance requirements vary greatly among universities, it is very difficult, if not impossible, to compare the effectiveness of their education processes. This cultural facet makes it difficult to set certain goals, necessary in teleological planning and lends itself more to setting general directions, as in evolutionary planning.

Finally, university cultures tend to be values driven. As Birnbaum (1991, p. 55) stated, "A goal is a value premise – a statement of what 'should' be that is meant to help guide decisions." However, there are many value premises in a university, some expressed, some latent, some widely held, others less so. Some are conflicting, which prevents goal optimization. It is quite common that administrators may have competing values with those of faculty members. Faculty often clamor for smaller class sizes, especially at the undergraduate level where hundreds of students may be placed in a single class. Administrators, on the other hand, welcome the cost savings of larger classes. This cultural characteristic, too, favors evolutionary planning over teleological planning. If teleological planning is used, the bounded rational approach would be proper, in that it allows for the satisficing of goals within the competing values of the university's culture.

CONCLUSIONS

Clearly, because universities have so many unique characteristics, there is no single approach to planning that would be a panacea. Instead, as Etzioni (1967) posited, a blend of evolutionary and teleological planning approaches must be utilized. In order to determine which to use in any given circumstance, planners must examine the university through all four frames of Bolman and Deal's (2008) model. They must look at the key characteristics of that university and forecast how they might interact among themselves and with the planning process. Truly, university planning is a conceptual challenge! Figure 2 below provides a visual representation of these relationships and complexity.

University Characteristic	Primary Frame	Probable Planning Approach
High Interdependence with Accrediting Agencies, Professional Standards, and Governmental Regulations	Structural	Teleological
Low Interdependence with Accrediting Agencies, Professional Standards, and Governmental Regulations	Structural	Evolutionary
High Independence from the Environment	Structural	Teleological
Low Independence from the Environment	Structural	Evolutionary or Mixed Scanning
High Goal Ambiguity	Structural	Evolutionary
Low Goal Ambiguity	Structural	Teleological
Loosely Coupled	Structural	Evolutionary
Tightly Coupled	Structural	Teleological
Organized Anarchy	Structural	Evolutionary
Sufficient and/or Flexible Resources	Structural	Teleological
Insufficient and/or Inflexible Resources	Structural	Evolutionary
Clear Vision and Mission	Structural	Evolutionary
Ambiguous Vision and Mission	Structural	Teleological
High Institutional Status and Success	Political	Teleological
Low Institutional Status and Success	Political	Evolutionary
High Shared Governance	Political	Evolutionary
Low Shared Governance	Political	Teleological
Strong Shared Culture	Cultural	Evolutionary
Weak Shared Culture	Cultural	Teleological
Highly Values Driven	Cultural	Evolutionary
Weakly Values Driven	Cultural	Teleological
Strong Division between Faculty and Administrative Values	Cultural	Teleological
Little Division between Faculty and Administrative Values	Cultural	Evolutionary
Strong Division between Faculty and Staff	Human Resource	Teleological
Weak Division between Faculty and Staff	Human Resource	Evolutionary
High Faculty Commitment and Tenure Rates	Human Resource	Evolutionary
Low Faculty Commitment and Tenure Rates	Human Resource	Teleological

Figure 2. University characteristics, primary frames, and probable planning approaches.

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ABSTRACT

Most authorities on educational planning and change recognize that each situation is somewhat unique and that in complex organizations, like universities, a blend of approaches is necessary. Following the premise of the need for universities to approach planning from multiple perspectives, the purpose of this paper is to briefly explore the unique nature of universities and how this helps to define the considerations that must be taken into account when deciding which planning approaches should be used.

To accomplish this purpose, two primary frameworks are blended: Birnbaum's classic text on the characteristics of universities and Bolman and Deal's four frames for analyzing organizations (structural, human resource, political, and cultural). Against this backdrop, various approaches to educational planning are examined, e.g., incremental, bounded rational, comprehensive rational, mixed scanning, and developmental, to discern the situations and conditions under which they are appropriate for university planning. The overall conclusion is that due to the complexity of university characteristics and the need to examine the university's needs and conditions through each of the four frames, university planners must be well versed in all approaches in order to select the one(s) most appropriate for a particular planning endeavor.

Detrimental Effects Of White Valued Walls In Classrooms

Kathryn J. Grube

ABSTRACT

Contrarily to color research, white values of paint are the most commonly applied finish selection on classroom walls today. White walls have been used in American schoolhouse settings since the first discovered paint, also white, was invented and made available some two hundred years ago. Originally, white paint was seen as hygienic and structured in demeanor, and was used as an agent to enhance visual capabilities in closed settings due to dark-hued building materials and an absence of electricity. Since then, using white paint for classroom wall finishes has remained as a perpetual design tradition that is causing a disservice to our academic and educating potentials. White walls are proven to cause detrimental psychological effects, such as anxiety, disruptive behaviors, lack of focus, and depressive moods to students and educators that spend time within the space. These types of effects dull-down learning capabilities and discourage morale. Color research has proven these negative facts for over a century now, but white walls remain constant in our educational facility design from a fallacy of misperception largely due to tradition, misinformation, and ease of maintenance. The question is why.

INTRODUCTION

Interior educational environments with white values of walls are known to induce anxiety, dissipate focus and concentration, and be a foreshadowing to petulance in end users. In 1947, Louis Cheskin, founder of the Color Research Institute of America, publicized his research discoveries as public warnings when he expressed, "White walls, as we know, are an optical strain and a psychological hazard" (Cheskin, 1947. p. 158). More evidence repeating Cheskin's findings has occurred throughout the decades, however, values of white have withstood these types of publicized cautions, and have somehow managed to remain as a design staple on the classroom walls of our educational interior architecture. Despite the vast amount of classrooms that have traditionally-colored white walls, values of white used on classroom walls give the learning environment the psychological appearance of being sterile and depressing, and can also cause glare, eyestrain and discourage learning (Birren, 1961; Mahnke, 1996). Color schemes with various values of white, including off whites and grays, when used on the walls within a learning environment can be perceived "institutional-like" from its origins of use in medically sanitary and hygienic oriented facilities and in structured schoolhouse settings, and ultimately become psychologically monotonous to its end users. This same droning feeling can be present in the space when shades of beige or taupe are used. These types color schemes are often referred to as being monotone, due to their unvarying quality and lack of psychological stimulation and interest to the end user of a space. Fittingly enough, the depression era of the 1930's was also referred to as the "taupe age," which speaks descriptive volumes of melancholy and gloominess that can be representative with monotonous color schemes (AFCEE, 1999).

In his 1976 case study, Küller showed how an environment with color not only benefits humans psychologically, but also increases focus and positive behavior, and ultimately enhances learning. In addition, Küller showed that being in white or gray class-

room environments has a negative effect on its inhabitants, as shown by increased student irritability and difficulty maintaining concentration. Both of these symptoms proved to be detrimental to the promotion of learning (Küller, 1976). The same types of negative reactions, due to white walls and fluorescent cool white lights, have been observed in many case studies involving learning environments such as Grangaard's dissertational study in 1993. A person sees the greatest overall distribution of color that is present within a given setting. In a classroom environment, the largest distribution of color comes from the walls. The walls have more visual weight due to their mass than furnishings or artwork possess alone; hence, the occupants of the classrooms generate their feelings towards an environment based on what the wall color portrays. Despite what color research has shown, the tradition of using white walls continues, and is a great disservice to students and professionals. "Industrial white, off–white and white must not be considered as satisfactory" [for learning environments], (Grangaard, 1993, p. 93). In 1978, the National Bureau of Standards advised this very same concept in Pierman's report:

> At present, the selection and specification of color in certain areas of our man-made environment, as buildings, is largely related to anecdotal evidence of effectiveness or only to changing styles and variable tastes of individual designers. While this condition may only result in superficial displeasure of users, in some instances it results in critically altered functions and goals (p. iii).

Values of white are neutral shades and are also considered "classic" in nature, but the presence of color is far superior than the absence of color, classic or not, for end users in a classroom (Sherwin Williams, 2011).

ORIGIN AND USE OF WHITE WALL TRADITION

From where does the tradition of using white painted walls in our classrooms originate? White walls have been in existence since the ancient Egyptians who discovered that mixing gypsum and chalk would create a white limestone plaster. They also used this concoction to make a white wash that covered the inside and outside of the walls of their homes to combat the fierce Egyptian heat (King-tut uk org, n.d.). This practice of using natural minerals stood the test of time for thousands of years, which eventually led to the development of the first type of paint medium made with milk in the 1800's. Mixing gypsum, lime, and earth pigments with milk achieved the first type of "paint", which was called "milk paint". During the 1800's, most settlers in America had access to a cow or goat to the make the simple milk paint recipe that was used inside of country homes and on furniture. (The Old Fashioned Milk Paint Company, n.d.). White was the first hue to be discovered and manufactured. The newly available white milk paint became dominantly used due to its ability to transform architecture by providing a clean, fresh finish that brightened dark interiors.

Architecture styles in the 19th century stripped away the decorative ornamentation of previous architectural periods, creating the new vogue of simplistic lines and clean palettes (Wigley, 2001). Like all historical architecture through time, the 19th century style of architecture was based on the trends of the latest fashion. During the 19th century, fashion and architecture were luxuries that could only be enjoyed by the wealthy. "Paint colors have historically been responsive to economic and cultural trends, as in the 19th century use of white paint to indicate wealth" (Vodvarka, 1999, p. 6). Literature was also prevalent during the 19th century and writings of Mark Twain, such as *The Adventures of Tom*

Sawyer published *in* 1876, captivated many audiences. Derivative of the poverty-stricken Tom Sawyer character, whitewash was often referred to as the "poor man's white paint" (Twain, 1876).

Another instance of the promotion of white came from the architect and writer Le Corbusier. In his book of 1925 *The City of Tomorrow,* he wrote that all of Paris should be white to purify the city, which was a reference to whitewashed Mediterranean houses of ancient times. Le Corbusier had the opinion that the white wall was to be used to exhibit art, so that anything that did not fall into the category of modern would look like a "stain" upon it. He felt a white wall was the perfect background and would purify artwork that was hung upon it. Although it is anecdotal, it appears that Le Corbusier could be at the forefront of having museums display artwork on white walls, which appears to have begun in the late 1930s at the Museum of Modern Art in New York City. Exposing society to the prolific use of white walls only confirmed the thought process that white walls were superior environments for hygiene and structured institutional settings. This could be a correlation to the tradition of using white classroom walls with colorful student artwork displayed for "decoration" as is similarly done in museums. Le Corbusier, after all, was one of the most prominent architects of his time, but did not focus on educational facilities design. He is often criticized for his use of futuristic, "modern" elements in his creations that failed to promote the benefits to the inhabitants. "What was the function of a house? Le Corbusier arrived ('scientifically' he assured his readers) at a simple list of requirements, beyond which all other ambitions were no more than {romantic cobwebs}" (De Botton, 2007, p. 22). Nonetheless, Le Corbusier had an implausible impact on the field of architecture and he and his designs are still commonly studied in architecture and design programs today. The history and tradition of the use of white paint in classrooms continues along with Le Corbusier's legacy, regardless of what has been proven otherwise.

The detriments of white walled environments are not obsolete for only classroom environments, but do hold an overall consistency with their negativity towards learning when used in various interior settings. In 2003, Englebrecht of the Chicago office of Perkins and Will (architects/interiors) wrote a paper that was presented at NeoCon (the largest design exposition and conference held in North America each year) entitled, *the impact of color on learning.* In it, the author discussed an independent study that was conducted in 2003, and designed to confirm whether color did or did not affect accuracy in business environments. The study included businesses that used white and off-white walls in their working environments versus environments enriched with color. In the white and off-white working environments there was a 25%+ reduction in accuracy and efficiency of its workers. This independent study confirmed the U.S. Navy's conclusions that a colored room does increase the accuracy of its inhabitants (Engelbrecht, 2003). Another entity that has similar convictions about the harmful effects of white wall use is the United States Air Force. In their *Facility Design and Planning* pamphlet, the benefits color provides to function and aesthetics is discussed at great length. This discussion also includes the benefits to classroom environments with proper color use. The second item found under the heading "color considerations include" states "the elimination of too bright values, such as stark white, that can cause disturbing wall reflections and glare" (p. 8).

ADVANCEMENT IN PAINT

During the 19th century, milk paint was accompanied with whitewash for a paint

medium to use on building interiors and exteriors. Whitewash was used in early America as a more durable alternative to the milk paint, but was made from calcium hydroxide or slaked lime and chalk. This gave whitewash its white color and opaque final finish. Paint began to evolve in quality by the 19th century with the addition of white lead to the whitewash mixture. This lead provided opacity to the paint and exhibited better "hiding" characteristics on the surface to which it was applied. The white lead also gave more resilience to the paint and assisted in eliminating the problem of mold and mildew from developing. (Chase, n.d.).

Paint technology developed further in 1916 when this white pigment with superior coverage and durability allowed for a paint to be available that far surpassed the whitewash derived from natural resource minerals. In the 1920's, the new white paint gained popularity for use in American interiors in the popular Colonial Revival architecture occurring since the early 1900's (Stark, n.d.). This novel white paint gave a new sense of being clean and "hygienic" to inhabitants of commercial and residential architecture. White was once the signature paint color for the wealthy as was shown by its use on the interiors and exteriors of buildings and homes. Its use denoted a pronounced denominator of being fashionable, clean, and bright within its characteristics. White walls were also predominant throughout the 1930's when advancements in manufacturing technologies of paint pigments allowed new access to paint to other classes of people besides the wealthy (Stark, n.d.). Up until the 1950's, lead was used in oil-based paints to act as a binder that would also inhibit mold and mildew growth, hence giving way to lasting durability. Being found toxic, lead based paints were eliminated after 1950, giving way, in the past 30 years, to water based paints using acrylic resin emulsions. As technologies advance, the demands for environmental friendly qualities continue to become requirements. Titanium dioxide replaced the white lead in the white pigment. Titanium dioxide is also still used today in both white and colored paints for superior coverage and hiding capabilities (Chase, n.d.). It seems apparent that the traditional use of white paint seems to stem from its lengthy availability for human use. It was the first of all hues of paint to be manufactured and all other colors of paint still today contain a portion of white paint, with its titanium dioxide, within their recipes for the base mixture.

School buildings in the U.S. existed long before paint itself ever became available. The first school building was founded on April 23, 1635. It was the Boston Latin School, located in Massachusetts and is still in existence today (Boston Latin School Association, n.d). With the development of white wash in the U.S. nearly a century later, the newly available finish applied on the walls in classrooms had to be a most welcomed, refreshing, and functional change for the students and educators. Before this, the space was habitually dim in nature due to the dark hues given off by the construction materials available at the time. These same materials would also darken over time due to natural aging of wood, as well as the absorption of soot and wood ash by the floors, walls, and ceilings from the heating that took place in winter months.

An additional factor for white walls becoming a national tradition for schools is that the widespread use of electricity did not begin in to the U.S. until the late 1880's. At this time, Thomas Edison began implementing his patent for electricity distribution, which made practical use of his reliable incandescent light bulb. Electric lighting was another new innovation that was originally provided for the wealthy. It was first used in Chicago in 1880 at the Palmer House Hotel for the Republican National Convention. The general

public, including school facilities, which were located in major cities in the U.S., did not have access to electricity until 1920 (Tell City Electric Department, n.d.). By then, the advancements in technology had allowed white wash to evolve into a far superior coverage medium in the form of white paint. White wash and white paint, both being bright in their capacity to reflect light, would have allowed a more functional setting for teaching and learning to occur. The brightness alone of the white-hued walls would have been far superior for educational performance as compared to the previous learning environment, whose functions were restricted by the availability of daylight, oil lamps, and candles in the already dark-material constructed schoolhouse structure. With white being the first available color for washes and paints, as well as being the most functional classroom wall color solution during the time of its invention, it is no wonder that the tradition of using white on classroom walls as a design standard was born.

NEGATIVE EFFECTS OF USING VALUES OF WHITE: A BRIEF WALK THROUGH HISTORY

The use of white paint on classroom walls, with its high light reflectance value, causes the pupils of the eye to constrict and results in a distraction to vision (Birren, 1961; Cottreau, n.d.; Mahnke, 1996). From the mid 1950's throughout the 1970's, white wall use became so widespread that most interiors, including both residential and commercial structures, implemented them as a common rule of thumb without question (Mahnke, 1996). Designers in the 1960's and 1970's were using more glass, aluminum, and steel in their interiors around the world due to technological advancements. They did however, have the misconception that if all the walls were painted white, then the teacher would become the focus for the students and not the environment. It sounded good in theory, but the results of the design on students were an unintentional failure of mass proportion. This period of architecture also fell short of its hopeful aspirations to be innovative and has been coined "soulless" and sterile (Fielding, 2006).

In the late 1950's, ten years after Louis Cheskin's psychological hazard findings of white walled classrooms were first presented, a West German government agency's study on color headed by Heinrich Frieling, founder of the Color Psychology Institute of Germany and founding member of the International Association of Color Consultants/ Designers (IACC), concluded the same, that white walls depicted an environment that was "empty" and had "no vitality" (Mahnke, 1996). Frieling conducted his study on over 10,000 children, ages five to fourteen from different regions around the world. After removing the children from white or gray rooms and placing them in rooms of color, levels of nervous tension lowered, concentration increased, and learning performance accelerated. Additional studies by various academic researchers in the 1980's were conducted using Frieling's color palette systems and all were unanimously conclusive of the positive influences of color to lower stress levels, reduce off-task disruptive behaviors, amplify academic performance, and most impressively, increase IQ scores (Pilaroscia, 2010).

After 50 years of proven research, designers finally started to understand and appreciate the value of color and in the 1980's began implementing colored walls in small quantifiable measures. Sadly, the use of colored walls in academic settings was of small proportion compared to the number of schools in operational existence and the implementation of colored walls in classrooms was short lived due to the influence of tradition, people's conditioning of its use, and the design professionals who were unaware of the

significance of color's psychological impact. The classroom environments of schools tend to follow the pathway of industry and return to the "old faithful" color selections of white values regardless of what the negative scientific research states about its use (Grangaard, 1993). This correlates with the fact that schools were originally designed as learning "institutions", where hygiene, discipline, and structured order set the precedence for their inhabitants. This mentality in design is seen in various establishments such as medical, prison, and educational facilities whose name often includes the word "Institution".

Although never truly leaving the design staple category, in the 1990's, an encompassing trend resourcefully rejuvenated a palette of white walls back into the lime light of use in interior design. Designers became more "creative" in their use of white paint. To justify the creativity, gray was added with the use of bright white and was portrayed as an "innovative technique" in design concepts. The only difference from previous white wall use was the contrast exhibited in the design effect from using brilliant white walls with shades of gray in carpeting or other finishes in the room (Fielding, 2006; Mahnke, 1996). Institutional gray infiltrated floors, walls, and furnishings in all types of building structures, including schools. These types of monotonous colored environments used in the 1990's were once again widely proven to create the negative effects of anxiety, fear, nervous tension, and depressive sorrow with its inhabitants. Although residential wall colors were quick to change and varied according to the preferences of the owners, classroom design remained stagnant with its vast use of white walls. Despite the new terminology of the "creative innovation" in the 1990's, the sterile color finish selections were rejuvenated as design standard excellence and solidified their place within classroom settings.

WHO DESIGNS AND PLANS OUR SCHOOLS?

Responsibility

So, who is responsible for setting the standards for color use and finish selections within American classrooms? It seems that it should be the US Department of Education (USDOE). However, the US DOE is not responsible for school design, planning, or construction of our nation's school facilities. The US DOE functions to establish policies on the different aspects of federal financial aid for education, collecting research/data on our nations schools, and enforcing educational laws in accordance with privacy and civil rights mandates (USDOE, 2011). The design and planning of school facilities is actually left up to each individual state to decide what is to be implemented in their state's school facilities. Each state has its own board of education that determines the facility guidelines that are to be used for the design and planning of its K-12 public schools. Of course, the facility guideline manuals in all (50) U.S. states must abide by the safety, health, and welfare of its occupants as determined by national or state and local building codes. When it comes to the benefits of color however, not one U.S. state appears to offer any type of standardized guideline for its educators or design professionals to utilize to promote learning through color use in the classrooms. Again, without the knowledge of color relayed to the ones who write the checks as representatives for the construction of our nation's schools, how can color ever become a priority to enrich our learning environments?

The boards of education in each of the 50 states typically leave color selection up to the professional architect. The architect is assumed to have the knowledge, skills, and training to expose and recommend color to the educational facilities owner representative

for a given construction project. Because color is almost never recommended to the school owner's representative by the architect, the "disconnect" that exists between the benefits of color in the classroom and its implementation becomes obvious. Color selections being typically specified by the architect on the contract documents, such in the written architectural specifications or construction plans themselves, and are then to be submitted for approval to the owner's representative from the school facility on an individual basis of project construction. The architect becomes the ultimate recommendation for color usage or lack of for classroom environments. The faculty, staff, and administration of any school facility, specialize in what they are educated and trained to do: educate students and run the operations of the facilities that service them. These educational facility employees, who are often owner's representatives for a given construction project, trust their project architect and design team for their guidance in achieving the best possible educational facility design available through their low-bid method of project award. It is expected that the architect's experience will guide the school employees in the phases of design and construction and will best serve the functions of their learning facility. This leaves the recommendations for the selection of colors to the project architects, which are again to be turned over for owner approval. Without the services of an interior designer, color consultant, or architecture firm that promotes color use in classroom environments, the outcome of the school's construction project once again remains at the mercy of what is recommended to them by their hired architectural design team professionals.

The use of white paint, as designated by the architect for classroom wall paint, is one of tradition and is unfortunately misconstrued as being effective in enhancing learning performance within a classroom setting (Fielding, 2006). Architects, general contractors, and subcontractors, who are the lowest bidders, are usually awarded school construction and renovation contracts due to state funding spending requirements for public works projects. Educational facilities limited funding, carefully monitored budgetary constraints, and fast track completion schedules to maintain school year occupancy, often compromise the quality of workmanship provided for the project. With these factors in mind, the expectations of school owners often go unmet after a contract is awarded to the lowest bidder. This is often due to the low bidder's poor performance exhibited from inexperience and uneducated decision-making, which often results in delayed project completion. (Barnes, 2010; Kahiwagi, 2010; LePatner, 2008; Schumaker, 2003).

By selecting a traditional, neutral white value of paint for the walls, less time is needed by the design team and costs are reduced as compared to the time and expenditure necessary to design a space with well-developed color schemes conducive to learning. The neutral paint selection also eliminates the need to hire an interior designer or other type of color consultant, which would also result in added costs and additional time accrued for the project's completion. There is a schedule to meet and generally only a low profit to be made, so color variety in wall paint often is not deemed a priority. Without a written requirement for colored classroom walls requested by an educational owner representative and provided by the architectural firm for other trades to provide, colored hues of walls become obsolete and are not provided. If the educator representing the school's facility does not request color, the design team or project architect typically assigns a color for the classroom walls and then recommends it to the school's representative for approval. Once the owner's representative approves it, it is executed.

Consequently, architects, who are required to have a complex knowledge of the

exterior skin of a structure, and the building systems and technologies for maintaining safety and function, often consult with engineers for the interior provisions of electrical, plumbing, and mechanical codes and requirements. The education and training architects receive regarding structural and safety requirements of a design is extensive, but it appears, in retrospect, that the instruction for specialty items, such as environmental color psychology within the interior built environment is minimal. (Lippman, 2010). Lippman, who chaired the American Institute of Architects New York (AIANY) Committee on Architecture for Education from 2001 to 2004, is also a senior staff member of the Educational Practice Group at a New York architectural firm. He confirms, in his 2010 book on evidence-based design of primary and secondary schools, that there is a lack of specialty knowledge introduced in architect educational curriculum:

> Building public schools in the United States has become a specialized practice in which the architect can potentially evolve from an artist whose interest is in the exterior aesthetic to a leader in the field who not only values and appreciates design but, most importantly, understands how people acquire and master both in- formal and formal skills…While design professionals should have these skills, they must also be trained to analyze research on how people learn and transfer this information to the design of places that promote learning. If design professionals desire to advance their role from merely building to understanding how learning occurs, they can become agents of change in the creation of this particular building type (p. 2).

With meager budgets and construction funding constraints, fast track scheduling, and customary methods for designing school projects, it is easy to perceive why interior color variety on classroom walls often falls to the waysides of tradition.

A BRIEF HISTORY OF COLOR RESEARCH AND CLASSROOM WALL COLOR RECOMMENDATIONS

1900 – 1950's

As early as 1900, various designers, planners, and facilities groups from multiple nations have been recommending what colors and types of finishes should be implemented in classroom design so that occupants will benefit academically and psychologically, and the functional needs of the learning facility will be met. For example, "Different colors themselves convey different impressions to the mind, yellow, for instance, conveys the impression of luminosity or brightness" (Hurst, 1900, p. 34). As George Hurst stated back in 1900 and also as Isaac Newton discovered in 1666, colors have meanings and establish moods that cause a psychological response in any given setting.

In 1929, the Interstate School Building Service in Nashville, TN released a book entitled *For Better School Houses*, that promoted the colors that would best support the moods or feelings most beneficial to the students and instructors in school settings. The publication recommended subtle paint values of bluish-green and peach for areas that students would use for long-term durations. The basis for determining what paint colors would work best in various areas for ceilings and walls was a derivative of the scientific research done by the Illuminating Engineering Society (IES) (Interstate School Building Service,

1929). The use of color hues by warm or cool category on the Munsell color wheel were also strategically placed in order to give an adverse psychological effect to allow the room to "feel" warmer or cooler depending on the function of the given space. For example, warm tones of "peach" were implemented in areas with vaulted ceilings or in windowless or darker rooms to counteract for the absence of natural light. White, ironically, was only utilized on storage area walls and ceilings to assist with the installed lighting during the short time an occupant went in to stock room to acquire needed items (Interstate School Building Service, 1929).

Wall color variety continued to be recommended in classrooms throughout the 1940's. In 1946, New York's public school system tested learning performance and achievement increases in students by using different color schemes on classroom walls. Pastel shades were previously adopted state wide in 1943, and had six color combinations with the sixth being peach and rose in hue. New York and a very few other schools in the United States, were utilizing the principles of color dynamics, which paint companies were promoting in the 1940's. These colors consisted of medium to light value hues of blues, greens, and yellows for example, that eliminated the excessive brightness of the white paint color as well as the depressing nature of dark colors. The paint companies also promoted the use of focal walls behind the instructor that were painted in a darker or lighter value than the side walls. Again, the feeling of color was also endorsed to put cool colors on classrooms that had south or west exposures and warm colors with north or east exposures. The sole colors of white paint recommended in the school settings were either off-white or light cream and were only to be placed on the ceilings (*Time*, 1946).

New Jersey school systems adopted New York's concept of pastel paint shades in the late 1950's when they replaced the classroom finishes in a select number of schools that had yellow-brown wall paint, black chalkboards, dark flooring, and dark finished desk furniture for both the students and instructors. Along with the pastel shades used for the walls, chalk boards changed from black to green, flooring was changed to a light neutral, and furniture with natural wood finishes was designed and installed in classrooms. The reasoning for these changes was related to scientific discoveries that showed changing the colors of the classroom finishes and furnishings, would result in improved student academic performance and increased concentration. They also used color to assist in the diminution of the number of cases of eyestrain within the student population. Based on these scientific discoveries of the power of color, New Jersey school boards promoted the use of color because of the positive feelings it induced within a school and the resultant improvement in students' attitudes towards school. This, in turn, led to a more attractive and enjoyable place for students to attend (Chamberlain & Kindred, 1958).

1950's through Present Day

From the early 1920s through the 1950s until today, researchers and design professionals continue to recommend and proclaim the power of color variety on classroom walls. As it was originally recommended in the 1920s, an accent color on the teaching wall or wall behind the instructor that is different in hue than the side and back walls is still recommended today. American Industrialist and founder of the Ford Motor Company, Henry Ford, also used this concept of a focus wall to maintain concentration for his students training to be placed on the assembly line in the early 1900's (Fielding, 2006). The differ-

ent color on the focus wall achieved a brighter and uniform illumination and allowed the students to focus directly on the tasks in front of them and maintain progression in advance of their supervisors (Fielding, 2006). A color that is a shade darker in value than the other three walls, or a contrasting shade or hue, is recommended on the teaching wall to provide distinction from the different colors of the chalkboards or white boards that are present in the room and inevitably attract student focus (Emory College, 2010; Pile, 1997; TES Magazine, 2008). The colored accent wall also reduces eyestrain in students while taking notes and provides relaxation to the eye's pupil, which can otherwise have an unpleasant reaction when focusing on the monotonous tones emitted by glare (Birren, 1961; Cottreau, n.d.). Specific colors for classroom walls are recommended based on the learning objectives for the setting, desired functions of the room, and environmental considerations.

All colors that are recommended by researchers, however, appear to be of various muted values that correlate to the light reflectance requirements specified. Warm color palettes, such as shades of yellow and peach or cooler palettes of blue and green, account for the majority of hues recommended. Warm colors can also be selected to energize students; while cooler colors can be implemented to provide a relaxing setting that calms students (Cottreau, n.d.). As with the teaching wall recommendation started back in the 1920's, color hues for classroom walls are still being recommended in order to perform sensory tasks to change the occupants' perception of the temperature of the room in relation to the school's climate zone location. Warmer colors are recommended on east or north exposures, or in climates that have cooler climates or long winter months. Similarly, cooler colors are recommended on west or south exposures or in climates that are located in a climate that is predominantly warm (Pile, 1997; *Time*, 1946).

With sustainable and green building and design being a dominant issue in the United States today, lowering energy costs are a governing focus in school design and planning. Colored walls are also recommended for classroom walls to save on energy costs in school facilities. The use of colored walls in a classroom can actually alter a person's physical perception of the temperature in a room and allow the setting of heating and cooling temperatures to be reduced or increased accordingly (Cottreau, n.d.). By using warm colors, the classroom can appear six to ten degrees warmer than it actually is and six to ten degrees cooler with the use of cooler colors. This reduction or increase in temperature perception allows less energy to be used for thermal comfort achievement and results in less energy consumption and lower acquired energy costs (Cottreau, n.d.). Colored walls used in conjunction with complementary lighting types are also a strong team used to save on energy costs due to reflectance values emitted. As of 2010, the US Energy Information Administration (EIA) estimates that 13.5% of the United States total electricity consumption was from lighting alone (EIA, 2011).

Since the 1990's, design-based learning theories have become prevalent since the 1990's, which bring research and practice together. A. Brown and A. Collins brought this design-based theory into existence. What works in the real world, in lieu of the laboratory, should be dominant in learning situations to promote enriched learning. Some of these design experiments on design research of educational facilities were conceived to communicate relevant design solutions to practitioners and educational design professionals. This design based learning theory relates to this study in that it promotes a more realistic and enriched learning environment provided by color. When the colors of the "real world" are stripped from classroom environments, students are placed in a sterile, man-made, white

environment devoid of the psychological benefits of color. In this same sterile classroom environment that is most commonly used where our students learn, real-world color is replaced by dominant values of white on all surrounding wall and ceiling surfaces.

Considering this further, where in nature can an environment of total values of white be found? Winter months in colder climates with adequate snowfall are representative of this whiteness, but even then, the ceiling or the sky has sunshine and bright hues of blue that break up the monotony of the white blankets of snow on the ground. Here the white is on the flooring and on some decorative aspects such as trees and buildings, but is not on the walls that surrounds the person. The viewer can still see other entities in nature that have hues of color organically present.

EDUCATING OUR EDUCATORS

Over the past 100 years, the use of color in classrooms has been and continues to be promoted and advocated in numerous articles, books, design conference presentations, case studies, and the like. Sadly, only a small percentage of schools actually adhere to the recommendations for using colored walls in classrooms. "Consequently, the {physical} environment mistakenly became a little regarded factor in the learning process. During the period 1950 to present, there has evolved a growing body of literature that suggests a much stronger relationship" (Moore, 1991, p. 16). The key to any type of change or advancement in learning is being exposed to the knowledge. "Educators have not been in the forefront of research dealing with the relationship between behavior and {physical learning} environment" (Moore, 1991, p. 83). School design and planning continues to advance through innovations in technology that directly impact energy with the increased usage of sustainable classroom products; however, when it comes to the predominant use of colored classroom walls as a strategy to achieve lowered energy consumption in classroom design, change has been reluctant to take place (Pearlman, 2010). Despite all the studies showing the benefits of colored walls, traditional white values continue to be used.

With so many references on classroom design and the psychological impacts of color readily available, why is it that only a handful of these resources give any type of direction to owners' representatives of schools on how to implement proper color use within classroom settings? The available resources are more geared toward exposing professionals on why color is beneficial to learning and provide a general overview of how color works psychologically in general terms of color theory, but often do not give specific recommendations on how to achieve a given desired result for a specific school. "Currently, few resources are available to help guide teams wanting to learn how best to manage such a design process – or even where to begin" (Lippman, 2010, p. 15). Possibly, the lack of specific resources exists because all school facilities have different learning objectives and located in various regions of the country; and that emphasis and trust is placed from the school representatives with the design team or architect professional to educate them on their available options. In order to achieve the positive impacts provided by successful, evidence based color schemes in schools, facilities may need to consult a professional who specializes in the use of color in the design of school interiors. Although this is a positive step, many educators do not realize what properly selected classroom wall color can do for the promotion of learning and behavior according to the review of the related literature. Moreover, the benefits of using color (as selected by a color professional) to students and educators seems to be considered an unnecessary luxury item that the majority of educa-

tional facilities think they cannot afford or more likely, do not even know exists. With almost three and a half centuries of knowledge that shows how powerful and beneficial color is to humankind, white continues to be utilized as the traditional safe choice for walls in our classrooms. The proven and enduring fact is that humans need sensory variety; and sensory variety is provided by actual color hues. Minimal progression in implementing color in our classrooms has been accomplished by means of furnishings and other finishes, however, these items ultimately fail to create an enriched learning environment due to the smaller amount of color distribution they give off when compared to the walls.

Unfortunately, white walls have continued to dominate in educational facilities and remain as constant representatives for our academic downfall in our classrooms today. Without the architectural design team having the same type of color knowledge needed to support and recommend the use of color to promote an enriched learning environment, it seems inevitable that the traditional white selections for classroom walls will remain as a constant deterrent to the benefits of colored walls that can be reaped by the space's occupants. Without a school's owner representative being knowledgeable about the educational benefits of color and actually requiring color variety to be part of the written architectural specifications, odds are that they will receive the recommendation of a traditional selection in a range of white values on their classroom walls. Not utilizing our color research for its potential for prosperous achievement in our classrooms because of ignorance, or resistance to change, or perpetual tradition is an unnecessary adversity between the objectives of the nation's educational system and the potential outcomes available for learning performance and morale of our students and educators. It is apparent that bridging this disconnect can help to better our quality of education. The question is: How do we construct the bridge?

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