

Policies that Enhance Learning and Teaching

Shannon M. Chance, Pamela L. Eddy, Gavin Duffy, Brian Bowe, and Jen Harvey

Abstract—Educational institutions often implement policies with the intention of influencing how learning and teaching occur. Generally, such policies are not as effective as their makers would like; changing the behavior of third-level teachers proves difficult. Nevertheless, a policy instituted in 2006 at the Dublin Institute of Technology has met with success: each newly hired faculty member must have a post-graduate qualification in “Learning and Teaching” or successfully complete one within the first two years of employment. The intention is to build teachers’ knowledge about student-centered pedagogies and their capacity to implement them. As a result of this policy (and associated programs that support it), positive outcomes are readily apparent. Individual teachers who have completed the programs have implemented significant change at the course and program levels. This paper introduces the policy, identifies outcomes in relation to existing theory, describes research underway, and pinpoints areas where organizational learning has occurred.

Keywords—Faculty Development, Institutional Policy, Learning and Teaching, Postgraduate Qualification, Professional Development.

I. INTRODUCTION

DUBLIN Institute of Technology (DIT) has implemented a number of policies and academic development initiatives to support quality teaching and enhance student learning [1], [2]. This organization has a strong record of educational innovation. It was the first institution of higher education in Ireland to offer degree programs in college-level learning and teaching according to the Learning, Teaching and Technology Centre [3]. In 2006, DIT began requiring every incoming faculty member to have or to earn a postgraduate qualification in “Learning and Teaching.” This contractual obligation builds on the success of earlier programs that were offered to faculty on an optional basis beginning in 1999. That year, the institute founded what is now known as the Learning, Teaching and Technology Centre (LTTC). It provides opportunities for staff to build skills, enhance practice, and earn new credentials.

S. M. Chance is with the 2012-13 Fulbright Scholar in Engineering and Design Education at the Dublin Institute of Technology (DIT) in Dublin, Ireland (e-mail: shannonchance@wm.edu).

P. L. Eddy is with the an Associate Professor of Higher Education at the College of William and Mary, Williamsburg, VA 23187 USA (phone: 757.221.2349; e-mail: peddy@wm.edu).

G. Duffy is with the School of Electrical Engineering Systems at DIT (e-mail: gavin.duffy@dit.ie).

B. Bowe is Head of Learning Development in the College of Engineering and the Built Environment at DIT (e-mail: brian.bowe@dit.ie).

J. Harvey is Head of the Learning, Teaching and Technology Centre at DIT (e-mail: jen.harvey@dit.ie).

Overall, the LTTC seeks “to raise the professionalism, visibility, and status of teaching and learning.” It provides “a rich seam of expertise, resources and information about higher education, learning and teaching, eLearning and academic professional development” [3]. In addition to the qualification process for DIT faculty, the LTTC offers professional development courses, seminars, workshops, and individual tutoring options. It provides options for people in and outside DIT to obtain accredited degrees in the field of education, including Postgraduate Certificates, Postgraduate Diplomas, Master of Arts degrees in Higher Education, and Master of Science degrees in Applied eLearning.

Historically, LTTC programs have proven popular among DIT lecturers. Almost 300 DIT staff members have successfully completed a Postgraduate (PG) LTTC program. Since the 2006 requirement for an initial Postgraduate Certificate or Diploma was enacted, individuals have elected to continue with their studies—eventually earning master’s and doctoral degrees involving educational research. At DIT, PhD work is carried out within individual colleges; the number of faculty members seeking PhDs has risen steadily over the years as has the percentage of them conducting doctoral research related to learning and teaching.

This paper discusses programs and outcomes that are relevant to and associated with the new policy that states “From 2006, all academic staff appointed to the DIT, and without an equivalent qualification, are required to undertake the PG Certificate within 2 years of their starting date” [3]. The paper focuses on outcomes that are accruing within one of the four academic units of the institute—the College of Engineering and the Built Environment—and explores cases of perceived achievement. The paper discusses specific outcomes in relation to theory; identifies research underway to understand and assess outcomes; discusses preliminary findings regarding policy, planning, and organizational learning; and pinpoints areas of incongruence and opportunity within the system.

II. RESEARCH UNDERWAY

To investigate this issue, our team is conducting a three-part study. First, we developed initial understanding by reviewing existing documents [3], [4] and interviewing eight people from various parts of the institution to ask what changes they had witnessed (at the student, teacher, program, college, institution, and national levels) in relation to the work being done at LTTC. Second, we conducted a phenomenological study wherein we interviewed seven of the nine participants of a faculty-learning group that implemented changes in the

electrical engineering program (four of these seven also had been involved in phase one of the study). In order to broaden our sample, we are currently conducting phase three which involves an online survey that will ask questions similar to phase one. The survey is being disseminated to all DIT staff by email. Results from this data collection will be presented at the conference.

A. Research Questions

The first set of interviews sought to address the following research questions:

1. In what ways have DIT's institutional policies precipitated high levels of achievement in teaching and learning at the personal, departmental, college, institutional, and national scales?
2. In what ways is DIT using knowledge that emerges as a result of these institutional policies to improve subsequent practice?
3. To what degree does DIT reflect "Organizational Learning"?

The second and third questions yielded unexpected findings in our initial interviews, which will be discussed later in this paper. To extend our understanding of the topics listed above, we are currently conducting a follow-up survey (phase three).

Our second set of interviews included participants of the peer-learning group that implemented change in the electrical engineering curriculum at DIT. We sought to answer the following questions:

1. How did participants experience the learning group during this period of change? How did they interpret the roles of various people in the group?
2. What affect did using a learning group have on this transformation? Was the group needed? Was it helpful? Would the change have been as successful without the learning group?
3. What characteristics made it work? What convinced group members to implement new techniques? How can the same approach be used in a different context? What lessons can be learned for other engineering educators? What other factors were important (e.g., institute support and college support)?
4. Can the learning group model be used to foster transformation in engineering education in other contexts? What are the implications for engineering education?

This portion of the study helped confirm that noteworthy transformation has occurred in electrical engineering modules/courses and that across the overall electrical engineering program as well. Those findings are explained briefly in this paper and will be reported in greater detail elsewhere [5].

B. Research Methods

Operating within the constructivist paradigm and adopting a social constructionist perspective, the primary author conducted the first set of interviews with a purposeful

sampling of (a) people inside DIT who shaped and implemented the organization's Learning and Teaching policies and (b) others who have completed or are currently enrolled in the LTTC's postgraduate programs. Semi-structured interviews were conducted and interviews were transcribed. Coding and analysis of those data are underway.

Preliminary interpretations of the dataset were used to guide the second portion of the study, which used methods consistent with interpretive, hermeneutic phenomenology [5]. In this approach, participants share their personal interpretations of a specific phenomenon (in this case, activities of the faculty-learning group and its implementation of new student-centered techniques) to the interviewer/researchers. The researchers then interpret what was said and report the results. This process relies on two level of interpretation: (1) interpretation by the participants and (2) interpretation by the researchers [6]. The aim of this work is to develop deep understanding of the phenomenon. As for phase three, survey data will be analyzed and reported using descriptive statistics and analysis of variance (ANOVA).

III. SUPPORTIVE PROGRAMS AND OUTCOMES

Today, within DIT's College of Engineering and the Built Environment alone, approximately 10 of the 300 faculty members are conducting educational research in the pursuit of doctoral degrees (eight are studying education-related topics and two are studying technical issues at a nearby university). The College employs a full-time Head of Learning Development who guides the design and implementation of new programs. He also leads and conducts educational research, manages quality assurance processes, and supervises doctoral students as they apply theory and conduct educational research. He holds one of four positions created five years ago based on the perceived need to embed Learning and Teaching values deeper into the individual Colleges. Whereas staff members at the central LTTC cater to a diverse audience, education experts housed within each College have the opportunity to tailor their messages and their programs to address the needs and interests of their constituencies. Based on the perceived success of this role, the institution recently changed these from five-year contracts to permanent appointments.

This approach—situating professional development officers within individual colleges—is helping implement LTTC goals at the local level. At DIT, the Heads of Learning Development who are housed in the colleges work in tandem with the LTTC to assist College staff. They act as a primary conduit between the upper administration and the faculty on this decentralized institution where programs are located throughout the city. As a result, a core message that faculty receive within this institution is the value of good teaching and of focusing their efforts on each student's learning.

The influence of DIT's Learning and Teaching policies and programs can be seen far beyond the institution. Change is

also apparent at the national level. Today, many of the 13 other institutes of technology in Ireland have programs and policies in place that draw from DIT's framework. Fitzpatrick and Harvey [4] documented this process of transfer. Although they contributed guidance and leadership, they endeavored not to "deliver" prepackaged solutions to their colleagues on other campuses. Instead, they headed a group of people who worked together to define goals, challenges, and solutions. The title of their book, *Designing Together: Effective Strategies for Creating a Collaborative Curriculum to Support Academic Development* expresses these goals. Many of these policies and projects were developed with support from the Strategic Innovation Fund (SIF), a national program that was funded for two cycles [7]. The SIF-supported development initiative documented by Fitzpatrick and Harvey, conducted under the auspices of the Learning Innovation Network project, has been effective in enabling the Institutes of Technology throughout Ireland to pool their resources. Faculty members at all the institutes now have access to a wide assortment of professional development modules related to learning and teaching. They can accrue credits at their home institutions and (in cases where their home institutions are small and lack the resources to offer a full complement of modules) they can complete fully accredited degrees at another institution. This has continued after the cessation of project funding in 2012.

Such initiatives are intended to spur change on the ground. Efforts to build capacity through professional development of faculty are paying off. At DIT, there is clear and growing evidence of improved faculty and student learning. DIT's annual Teaching Fellowships provide highly visible examples of engagement in relevant issues. The Teaching Fellowship program has been funded nationally by the "Strategic Innovation Fund" (SIF). The process at DIT is managed by the LTTC, but the Teaching Fellows are chosen by the College so that the projects align to the strategic goals of each College.

In 2011-12 the nine projects funded by DIT/LTTC included such topics as *Critical Thinking*, *Critical Theory: Cross-School First Year Module in Critical Analysis* in the College of Applied Arts and Tourism, *Exploring Social Media as a Means for Fostering Student Engagement and Retention* in the College of Business, and *Scaffolding for Cognitive Overload Using Pre-Lecture e-Resources (SCOPE) for First Year Chemistry Undergraduates* in the College of Sciences and Health. Projects in the College of Engineering and the Built Environment included *An Activity-Based Approach to the Learning and Teaching of Research Methods: Measuring Student Engagement and Learning* and another project titled *Developing a Collaborative Virtual Learning Environment between Students in Cross Disciplines to Meet the New College Structure*. Fellowship projects tap the energy and creativity of faculty of all ages and levels of experience. The majority of the successful applicants have completed (or are currently completing) postgraduate studies in Learning and Teaching.

As part of this study, we explored outcomes of one

Fellowship project, conducted by a graduate of LTTC certificate and Master's programs, in detail. Under that specific Fellowship project, the awardee developed two position papers that provide a vision for how an engineering program can implement change effectively [8], [9]. His vision was informed by interaction with his peers; as part of the fellowship he organized a faculty peer-learning group. That group met periodically though his fellowship year to discuss issues related to facilitating group-based learning in their classrooms.

The peer-learning group included: three recent graduates of LTTC programs (who constituted the core of the group), the college's Head of Learning Development (who served as role model and advisor), four long-term faculty members who had not earned qualifications in Learning and Teaching, and one visiting scholar who was completing the LTTC certificate program. Together, the members of this group identified challenges and problems related to assigning group-based work in their courses. They determined ways to proceed with the implementation of group assessment and problem-based learning. The group tested a range of possible solutions and returned periodically to discuss the benefits and tradeoffs they experienced. This process allowed them to draw from each other's experience, existing research and theory, and from other precedents within the institute.

Phenomenological interviews conducted with seven members of the learning group confirmed that participation helped them implement group-driven project-based approaches. It helped them navigate the intricacies of assigning ill-structured problems, advising teams, providing formative feedback, and moving from summative assessment toward continuous assessment.

Similar peer learning groups have been conducted in the School of Physics. Another is slated for implementation in the School of Business this spring, funded by an LTTC fellowship.

IV. OUTCOMES IN RELATION TO THEORY

At first glance, success on the ground at DIT would appear to stem from good strategic planning and supportive policy. On closer observation, the policy appears sound but it does not seem related to a clear plan. Positive outcomes have been noted by a number of external review panels, but the larger institution does not appear to be tracking outcomes very carefully or using the results and examples to generate new, more effective responses at the institutional level.

The initial intent of this project (conducted primarily by a visiting scholar/external researcher) was to investigate institutional policies in an attempt to identify and describe a range of outcomes related to learning at various scales, with particular emphasis on Organizational Learning. The findings sought to address deficits of understanding regarding how strategic planning supports organizational learning [10], [11], [12], [13], [14], [15], [16].

For instance, Adams [10] articulated three crisis areas in the field of educational planning: (a) definition and identity, (b) theory / intellectual or scientific foundation, and (c) evidence of success and utility. Because there was apparent evidence of success in the LTTC process [5], it was assumed that a case study would help provide detailed documentation, evidence, and analysis of successful approaches that could then be used by others to promote Organizational Learning. Specifically, phase one of this research project sought evidence that DIT was using established planning principles in addition to iterative feedback to support Organizational Learning. The conceptual model for this process is shown in Fig. 1.

This framework provides a way to visualize effective leadership and planning—that which helps an organization excel despite challenges that arise over time. It shows an iterative decision-making process. Specifically, the model merges two of Kolb's [17] charts on learning approaches with the spiral described by Wilson [16] and Dewey [18] that underscores the iterative process of planning implementation and iterative learning, respectively. The circle at the lower left of the Fig. 1 represents Kolb's learning cycle, with Kolb's corresponding learning styles shown in various quadrants. According to Kolb, making complex decisions requires four distinct types of thinking. An individual or organization can enter the decision-making process at any point on this circle Kolb says, but must then cycle through periods of *concrete experience*, *observation and reflection*, *abstract conceptualization*, and *active experimentation* in order to develop appropriate, well-synthesized responses.

Today's constantly changing environments present challenges that can be used as opportunities for learning, development, and growth [19], [20]. They also present challenges that can overwhelm an organization's traditional ways of coping with change [15]. Universities need to observe outcomes of their actions and adjust their systems in order to stay afloat in times of change—those that do can reap substantial benefit [21], [22]. Rowley, Lujan, and Dolence [15] insist each organization will need to develop methods for adapting to highly fluid contexts in ways that align with its own "base of distinction, including its particular heritage, character, strengths, capabilities, and programs of excellence." Participants in our study at the DIT indicated that the change they were implementing was consistent with the collective ethos of this institute and their aim to serve students from the full spectrum of Irish society.

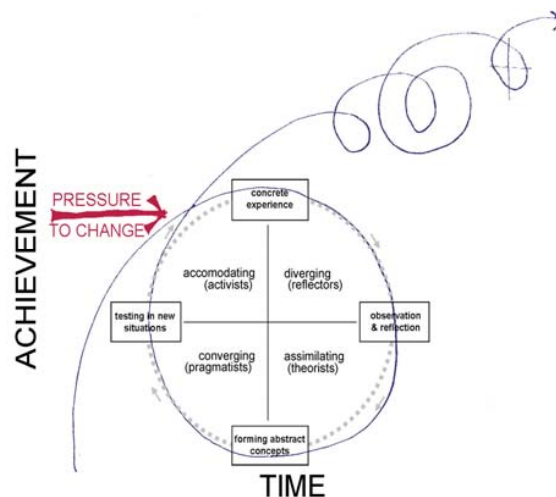


Fig. 1 Model for organizational learning that incorporates Kolb's (1984) decision-making model with ideas posed by Dewey (1938), Sanford (1962), and Wilson (1997). Source: Chance (2010)

Black and Gregersen [23] insist that changing organizations requires changing individuals first. Change starts at the level of person, a phenomenon that organizational leaders generally neglect. As a result, the authors argue that the failure rate of strategic change initiatives is as high as 80%. Meaningful change is more difficult to achieve in higher education than in corporate organizations because the system is more loosely coupled [11], [12], which exacerbates the disconnection between leaders and individuals who are in the trenches enacting change. Black and Gregersen discount the notion that "changing organizational strategies, structures, or systems will magically change individuals." Top-down change strategies rarely succeed. Engagement from the bottom, by individuals at the grass-roots levels of their organizations, is an essential component of creating permanent change. "Lasting success lies in changing individuals first; then the organization follows. This is because an organization changes only as far as its collective individuals change."

Individuals can work together to achieve critical mass (or a tipping point) and can thereby shift the larger group paradigm. The aggregate of many small changes can spark a movement [24], as is becoming evident at DIT. The example at DIT also underscores Black and Gregersen's belief that "changing other individuals first requires leading by example and changing oneself" (p. 10). Seeing the need to change is not enough to get a person to change; the person must also see or be able to visualize new behaviors and overcome the fear of poor performance in the initial implementation of the new techniques. At DIT, the presence of a group of people working at the grass-roots level helped give each participant the courage to act. The leader of the faculty-learning group changed himself first, just as Black and Gregersen recommend. He and the Head of Learning Development (who advised the group) provided convincing and effective models for others to follow, as noted by participants in phase two.

Participant 1: *what was useful was to have this sort of more formalized support [the Head of Learning Development] that said, 'Well this is a legitimate way of running a module and you can assess it on 100% continuous assessment.'*

Participant 2: *[The Teaching Fellow who coordinated the group] has run with this and [two other who took the Post-Graduate Certificate] with him and [one of those] I suppose sits beside him in the office so they're going to share naturally. And [the other] is relatively newer, a new member of staff ... they'd be the main ones [driving this change]. And the rest, as you say, kind of periodically come in.*

Participant 3: *assessing students on the spot, I find that difficult. I do it anyway but it's not something that comes naturally. ... I mean obviously you have to... if you want them to get the feedback that they need in time to be able to change their ways. You have to do that [and] that again would be something that [the Teaching Fellow] would have persuaded me of ... but I have to say I'm a reluctant implementer of that. And, I mean I do it because I believe him. But, you know, it's not something I enjoy doing.*

Members of the learning group understood that implementing the desired change would be challenging and uncomfortable, but they drew inspiration and enthusiasm from the group. They were able to develop their own creative new answers as additional challenges and problems surfaced. They used iterative thinking to help define problems and define solutions in a cyclical way [25].

The policy instruments included in a typology developed by McDonnell and Elmore [26] include: 1. *Mandates* that are used to result in compliance based on a set of regulations and rules. 2. *Inducements* in the form of transactions to motivate particular outcomes (often, funding is the main inducement). 3. *Capacity-building* in which funding serves as an investment to expand either physical plant or human capital to achieve greater outcomes. 4. *System-changing actions* in which authority among individuals and agencies is enhanced to result in changes to the system in which public goods and services are delivered (p. 134). Eddy [27] argues that links are evident between the type of policy instrument used and the resulting form of change. Transactional leaders [28] use mandates and inducements and once incentives are removed, the change ends [29]. Transformational leaders [28] instead use capacity-building and system-changing policy actions to help support longer-lasting and deeper levels of change. At DIT, the policy on professional development seems to be highly successful and draws from capacity-building institutional support. Yet, the plan for tracking its efficacy and aligning its success with the overall direction of the institute is not readily apparent.

V. DISCUSSION OF FINDINGS

A preliminary yet noteworthy finding discussed in this paper represents a type of paradox. Although institutional policies and LTTC programs are facilitating positive and verifiable change—and lecturers consistently voice the opinion that learning has improved at the level of the student, teacher, and program—the institution does not appear to be

following through as well as it could. Based on grass-roots success, one would expect a clear strategy to be in place regarding how the learning outcomes influence institutional change. One would expect to see the message of learning and teaching being delivered top to bottom. However, the participants in this study did not report seeing that. The clearest messages faculty receive about the institution's direction and intent, beyond the institutional requirement to obtain the training, appear to come from the LTTC or from within the four individual Colleges that comprise DIT. The central administration does not appear to be highly strategic with follow through regarding leveraging or aligning changes in teaching practices. There is little evidence of learning at the organizational level. Huber [30] synthesized 40 years of writing to come up with the following definition: "An organizational entity learns if, through its processing of information, the range of its potential behaviors is changed and an organization learns if any of its units acquires knowledge that it recognizes as potentially useful to the organization." Here, organizational learning is happening primarily at a single-loop level [31]. Incremental adjustments are made to practice based on local-level feedback. Yet, organizational learning reaches its true potential when double-loop learning occurs. In this case, existing assumptions and beliefs are challenged and transformational change ensues [31]. As it is, faculty members view the goals of the LTTC as disconnected from the goals of the central administration. Nevertheless, the LTTC has received ongoing (but fluctuating) financial support from the central administration. Leaders of the LTTC were able to gain the necessary support to get the new and unique policy adopted regarding faculty teaching qualifications. Central administration and the faculty union endorsed the policy. Today, that policy is generating benefits that help extend many years worth of success in teaching teachers to teach at the DIT.

Faculty stakeholders insist, however, that they are working without a coordinated plan. They acknowledge that quality support services are being provided that are effectively building their capacity to implement innovative educational pedagogies. Thus, the mandate for the required training has resulted in capacity building within the organization [26]. Nevertheless, faculty members do not see a clear vision nor understand precisely what their roles should be in bringing the vision forward. Stakeholders at the grassroots level do, however, have a strongly shared vision about what constitutes good teaching—thanks to the LTTC—and they are working together to implement what changes they can. Ironically, whereas this system seems less than ideal to the participants in our study, it is actually reaping benefits that might not be possible if the change appeared to be solely mandated from the top.

Today, many teachers at DIT are working to create a shared vision of how the theories they learn in LTTC classrooms can be applied. They are enacting change within their classrooms and across their programs, which indicates that double-loop learning has started to occur. Moreover, leaders in the College

of Engineering and the Built Environment are encouraging the work of such individuals in the hopes that a shared vision will grow out of the work. It appears that real system change or organizational learning—that which questions assumptions and practices—may well occur.

Based on existing theory, change movements are often most effective when they grow from within rather than being applied from above. This is certainly the case with transformative change that has occurred in DIT's electrical engineering program [5]. All participants in the second part of our study saw change as growing from the bottom up. Some expressed a desire for a clearer vision and stronger support from upper level leadership. The loose coupling [11] of the system means that this change is not yet occurring system wide. Moreover, there does not appear to be a mechanism for brining what is learned up into the institutional level.

It is worth noting that faculty members do not associate this (Learning and Teaching) movement with any specific person. They see it as consistent with the institution's ethos and mission, but they do not understand what strategic direction the central administration is taking. They have little to no understanding of the institution's organization chart or chain of command beyond the College level. They do not know who supports or funds the LTTC. Perhaps it is this ambiguity of ownership that helps put politics aside. Perhaps it allows faculty the freedom to define the vision for themselves. Many of them are investing their energy and creativity to enhance the College today. Yet, the organization is failing to harness opportunities greater change given its lack of institutional feedback and questioning of assumptions.

VI. CONCLUSION

Knowledge generated through this study can help DIT further the goals of the LTTC and use organizational learning more effectively. Documentation of successful practices—and dissemination of findings to an international audience—can promote understanding of the ways in which policy is influencing organizational learning and help others learn from DIT's experience.

Institutions of higher education typically fail to learn from their own experience, the experience of others, and from emerging evidence of success and failure [32], [14], [16]. Scholars of planning agree that organizations can benefit from using iterative planning processes that integrate emerging knowledge and experience [25], [33], [32], [12], [34], [15], [35].

Decades ago, Cohen, March, and Olsen [36] and Birnbaum [11] emphasized the importance of learning from experience. They challenged colleges and universities to become Learning Organizations. This change has not come naturally. Recognizing, studying, and refining the organization's practices for learning and self-assessment can have far-reaching benefits for the field of educational planning [14] and for society in general [16].

In this case, we can learn from the power of one innovative

policy to support effective learning and teaching. We can also begin to understand that what motivates people to change is not always strategic or planned from above. Nevertheless, having resources aligned with the intent of a given policy is essential. Participants in our study actually appear to have benefitted from the lack of a clear strategy, vision, and plan. Their grass-roots work is inspiring change and allowing the needed vision to grow, from the ground up!

ACKNOWLEDGMENT

S. M. Chance thanks the Fulbright Scholar program, Fulbright Ireland, Dublin Institute of Technology's College of Engineering and the Built Environment, and Hampton University for supporting her year abroad to conduct educational research.

REFERENCES

- [1] Dublin Institute of Technology, "Strategy on Widening Participation," April 2011.
- [2] Dublin Institute of Technology, "Strategy on Student Engagement," 2013.
- [3] Learning, Teaching and Technology Centre, "Celebrating a decade of innovation and good practice in learning and teaching," Dublin, Ireland: Dublin Institute of Technology, January 2010.
- [4] N. Fitzpatrick, and J. Harvey (Eds.), *Designing together: Effective strategies for creating a collaborative curriculum to support academic professional development*. Dublin, Ireland: Dublin Institute of Technology, 2011.
- [5] S. M. Chance, G. Duffy, G., and B. Bowe, A phenomenological study of learning groups as a mechanism for transforming an Engineering Education program, (submitted for publication).
- [6] A. Giddens, *New Rules of Sociological Method*, 2nd ed., Stanford, CA: Stanford University Press, 1993.
- [7] Higher Education Authority. "Strategic Innovation Fund," <http://www.heai.ie/en/sif>
- [8] G. Duffy, & B. Bowe, A framework to develop lifelong learning and transferable skills in an engineering programme, paper presented at the 3rd International Symposium for Engineering Education, 2010.
- [9] G. Duffy, & B. Bowe, *A strategy for the development of lifelong learning and personal skills throughout an undergraduate engineering programme*, paper presented at the Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments, 2010.
- [10] D. Adams, "Planning models and paradigms," in R. V. Carlson and G. Awkerman, Eds. *Educational planning: Concepts, strategies, practices*, White Plains, NY: Longman, 1991.
- [11] R. Birnbaum, *How colleges work: The cybernetics of academic organization and leadership*. San Francisco: Jossey-Bass, 1988.
- [12] M. Cutright (Ed.), *Chaos theory and higher education: Leadership, planning, and policy*. Baltimore: Peter Lang, 2001.
- [13] E. L. Holcomb, *Asking the right questions*, 2nd ed., Thousand Oaks, CA: Corwin Press, 2001.
- [14] J. B. Presley, and D. W. Leslie, "Understanding strategy: An assessment of theory and practice," in J. C. Smart, and W. G. Tierney, Eds. *Higher education: Handbook of theory and research*, vol. 14. Bronx, NY: Agathon Press, 1999, pp. 201-239.
- [15] D. J. Rowley, H. D. Lujan, and M. G. Dolence, *Strategic choices for the academy: How demand for lifelong learning will re-create higher education*. San Francisco: Jossey-Bass, 1998.
- [16] D. Wilson, *Project monitoring: A newer component of the educational planning process*. *Educational Planning*, vol. 11, no. 1, 1997, pp. 31-40.
- [17] D. Kolb, *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall, 1984.
- [18] J. Dewey, *Experience and education*. New York: Collier Books, 1938.
- [19] M. Fullan, *Leading in a culture of change*. San Francisco: Jossey-Bass, 2001.

- [20] N. Sanford, "Developmental status of the entering freshman," in N. Sanford, Ed. *The American College*. New York: Wiley and Sons, 1962.
- [21] L. Lauer, *Advancing higher education in uncertain times*. Washington, DC: Council for Advancement and Support of Education, 2006.
- [22] D. J. Rowley, and H. Sherman, *From strategy to change: Implementing the plan in higher education*. San Francisco: Jossey-Bass, 2001.
- [23] J. S. Black, and H. B. Gregersen, *It starts with one: Changing individuals changes organizations*, 2nd ed. Upper Saddle River, New Jersey: Wharton School Publishing, 2008.
- [24] M. Gladwell, *The tipping point: How little things can make a big difference*. Boston: Little, Brown, and Company, 2000.
- [25] S. Chance, *Strategic by design: Iterative approaches to educational planning*. *Planning for Higher Education*, vol. 38 no. 2, 2010, pp. 40-54.
- [26] L. M. McDonnell, and R. F. Elmore, *Getting the job done: Alternative policy instruments*. *Educational Evaluation and Policy Analysis*, vol. no. 2, 1987, pp. 133-152.
- [27] P. L. Eddy, *Using partnerships to achieve national goals*. Peer reviewed research paper at the International Conference on Higher Education, Paris, France, submitted for publication.
- [28] M. Burns, *Leadership*, New York: Harper and Row, 1978. H. Kelman, *Process of opinion change*. *Public Opinion Quarterly*, vol. 25 no. 1, 1961, pp. 57-78.
- [29] G. Huber, *Organizational learning: The contributing processes and the literature*. *Organization Science*, vol. 2 no. 2, 1991, pp. 88-115.
- [30] C. Argyris, and D. Schön, *Organizational learning II*. Reading, MA: Addison-Wesley, 1996.
- [31] C. Argyris, and D. Schön, *Organizational learning II*. Reading, MA: Addison-Wesley, 1996.
- [32] S. M. Chance, and B. Williams, *Assessing university strategic plans: A tool for consideration*. *Educational Planning: The Journal of the International Society for Educational Planning*, vol. 18 no. 1, 2009, pp. 38-54.
- [33] B. Barnetson, "Performance indicators and chaos theory," in M. Cutright, Ed. *Chaos theory and higher education: Leadership, planning, and policy*. Baltimore: Peter Lang, 2001, pp. 145-158.
- [34] G. Gordon, "Learning from quality assessment," in S. Ketteridge, S. Marshall, & H. Fry, Eds. *The effective academic: A handbook for enhanced academic practice*. Sterling, VA: Stylus Publishing, 2002, pp. 201-217.
- [35] J. P. Swenk, "Strategic planning and chaos theory: Are they compatible?" in M. Cutright, Ed. *Chaos theory and higher education: Leadership, planning, and policy*. Baltimore: Peter Lang, 2001, pp. 33-56.
- [36] M. D. Cohen, J. G. March, and J. P. Olsen, *A garbage can model of organizational choice*. *Administrative Science Quarterly*, vol. 17 no. 1, 1972, pp. 1-25.

Shannon M. Chance, Ph.D. earned a B.Arch. in 1993 and an M.Arch. in 1996 from Virginia Tech. She completed a Ph.D. in Higher Education Administration in 2010 at The College of William and Mary in Virginia. She is currently serving as the 2012-13 Fulbright Scholar in Engineering and Design Education at the Dublin Institute of Technology, in Ireland. Dr. Chance is a tenured Associate Professor of Architecture at Hampton University and she also teaches educational planning classes at William and Mary. She is licensed to practice architecture.

Pamela L. Eddy, Ph.D. received a B.S. in Economics from Allegheny College in 1982, an M.S. in Resource Economics from Cornell University, in 1985; and a Ph.D. in higher education administration from Michigan State University in 2002. She is currently an Associate Professor of Higher Education at The College of William and Mary in Williamsburg, Virginia. She is the author of *Community College Leadership: A Multidimensional Model* (Sterling, VA; Stylus Publication, 2010) and *Partnerships in Higher Education* (Thousand Oak, CA; Sage Publication, 2010).

Gavin Duffy is a Lecturer of Electrical Engineering Systems in the College of Engineering and the Built Environment at the Dublin Institute of Technology in Ireland.

Brian Bowe, Ph.D. earned a Technician Diploma in Applied Science (Physics) from Dublin Institute of Technology in 1992. He also received a B.Sc. in Physics and Mathematics in 1995 and a Ph.D. in 1999 from Trinity

College Dublin. He is the Head of Learning Development for the College of Engineering and the Built Environment at the Dublin Institute of Technology in Ireland.

Jen Harvey, Ph.D. is Head of the Learning, Teaching and Technology Centre at the Dublin Institute of Technology.