Key Characteristics of an Academia-Industry Partnership to Meet the Education and Training Needs In a Science, Technology, Engineering & Mathematics (Stem) Field

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Abstract

The purpose of this case study is to describe the characteristics of an academia-industry partnership that works together with industry to meet the education and training needs in a Science, Technology, Engineering, and Mathematics (STEM) field. The research consisted of interviews, focus groups, document analysis, gathering of artifacts, and observations of the partnership between a technical college and a STEM-related industry. The academia-industry partnership explored in this study contained the following characteristics:

1. *Technical Hands-on Education and Training Responsive to a Local Industry Need*
2. *Written Formal Agreement with Clear Roles and Responsibilities for Each Stakeholder*
3. *Involved, Experienced, and Competent Leadership and Oversight*
4. *Communication Ease based on Proximity, Integrity, and Relationships*
5. *Economy-based Vulnerabilities and Growing Pains*

In light of these findings, educational leaders should connect with local industry in their community to understand the role a college can play to help meet the needs for entry-level jobs.

Key Words: Academia-Industry, Partnership, STEM, Collaboration, Case Study, Education and Training

1. Introduction

College classrooms have often used their facilities as "living laboratories" that provide opportunities for discovery and innovation (Feldbaum, 2009, p. 7). Use of higher education resources have been key to technical fields, such as those involving the aerospace industry, to provide the education and training required to meet the demands of industry (Felix & Pope, 2010). Science, technology, engineering, and mathematics (STEM) fields are growing on a global scale, and the U.S. needs to "renew and redouble its efforts to identify and develop domestic human capital" to meet the increased demands of the STEM workforce (NSF, 2010, p. 5).

The Soviet launch of Sputnik in 1957 increased prioritization of STEM education (NSF, 2010). For several decades thereafter, the U.S. aggressively funded STEM-based organizations like the National Science Foundation (NSF) and NASA, while funding for STEM education through the National Defense Student Loan Program increased STEM graduate production. (Schwegler, 1982; NSB, 2007). The U.S. has failed to sustain focus on science and engineering education to the level reached when the programs began in the 1950s (NSF, 2010).

The U.S. commitment to advancing STEM has lost the momentum gained in the 1950s, creating a weakness in STEM-based education important to economic progress (NAS, 2005). Many stakeholders are concerned about the shortage of required STEM skills in the workforce, and the education and development process of future STEM innovators is a serious concern for the long term (Crouch, Finegold, & Sako, 1999; Hogarth & Wilson, 2001; Tamkin, 2005). The McKinsey Center for Government reported on the results of 8,000 surveys among students, employers, and educators, and found that only 45 percent of students and 42 percent of employers believed that students were being adequately prepared for the overall workforce (including STEM and non-STEM fields).

The report also noted that 72 percent of college educators believed the job of preparing students for the workforce was adequate, noting a huge disconnect between student and employer perceptions on college graduate readiness compared with the perceptions of the education providers (Mourshed, Farrell, & Barton, 2012). Mourshed and associates reported that of the nine countries included in the McKinsey Center survey, almost 40 percent of employers reported that one of the keys to entry-level vacancies was the lack of skills preparation, and 36 percent of employers stated that the lack of student preparation adversely affected the organization in terms of time, economics, and quality. Employers are reporting a gap in education and skills preparation across all employment sectors, and since this gap in skills is perceived to be a long-term problem, the 2020 expectation is that there will likely be a "global shortfall of 85 million high- and middle-skilled workers" (Mourshed, Farrell, & Barton, p. 11). Specifically, as it relates to STEM, the training and education gap in the workforce creates an opportunity for higher education leaders to provide a solution for bridging the gap (Nair, Patil, & Mertova, 2009; Nazzal & Hillsman, 2010).

2. Literature Review

The mission and purpose of higher education are often debated, with some seeing the role of colleges and universities as having more of a humanistic role, i.e. teaching people how to understand and care for each other, while others see educators as being responsible for providing material needs and applying knowledge to solve real-world issues (Bollinger, 2003; Harkavy, 2006). Harkavy prioritizes the use of institutions of higher learning to prepare students to positively contribute to a democratic society. Harkavy posits that higher education is designed to advance the causes of democracy and social justice, and colleges that do not achieve this objective are failures, regardless of what other areas they are successful. Robbins (1963) believes that the goal of colleges and universities is not to provide human capital for the workforce, but to supply society with graduates that will embody the standards of behavior and culture specific to where they live. Education that focuses on any goal outside of supporting "civic humanism" is categorized as negative (English, 2010, p. 2). Other educators believe that colleges can align themselves with community values and address local community needs simultaneously (Bok, 1990; Harkavy, 2006). When a gap exists between what students study and what is required by the local workforce, collaboration between educational institutions and local industry may prove to have benefits for both parties (Nazzal & Hillsman, 2010).

Educators that are against policies that support academia-industry partnerships believe that colleges are placed on a slippery slope that amounts to "hijacking the American Education system" (Emery & Ohanian, 2004, p.1). Academic purists have a difficult time supporting the role higher education plays in supporting economic development, especially since the traditional focus of colleges and universities have been an agenda geared towards liberal arts (Sparks & Waits, 2011). Kumashiro (2008) stated that supporters of academia-industry collaboration are on the political right and are concerned with protecting "economic privilege" (p. 10). Schools are reduced to being a form of capital serving the purpose of helping the cultural elite maintain power (Bourdieu, 1984). The politics and corresponding policies of commercializing academics are seen as advancing education by developing skills that contribute to economic and entrepreneurial progress (Harvey, 2009). Ultimately, proponents of favorable academia-industry policies run the risk of being perceived as supporting progress in the market economy over education that produces responsible citizens and advances democratic ideals (Giroux, 2004).

Neoliberals, a term given to proponents of academia-industry partnerships, are described as being married to the belief that all economic, social, and political agendas originate from a motive for profit (Giroux, 2005). Giroux (2005) believes that the policies of neoliberals are destructive to the same young people targeted by post-secondary schools, and are responsible for destroying the dreams the younger generation have for a brighter future. Neoliberals believe that for-profit organizations embody democracy and that the true citizen links commercialism to policies that negatively affect the country by minimizing regulatory power and government control while simultaneously turning the country's welfare over to greedy corporate interests (Peters & Fitzsimmons, 2001). The policies of neoliberals are considered counterproductive to the efforts educational institutions exert to create critical thinkers, and are construed by many as literally eliminating "the very possibility of critical thinking, without which democratic debate becomes impossible" (Buck-Morss, 2003, pp. 65-66).

Although the liberal ideology venomously attacks capitalistic principles, other perspectives believe that democracy was founded upon capitalism (Ladson-Billings & Tate, 1995).

Specifically, Ladson-Billings & Tate believe that capitalism was a key component in early America, represented by property rights and ownership, and linked to educational quality. Former Secretary of Education Margaret Spellings, in her Commission on the Future of Higher Education, espoused an educational system that linked the workplace to human capital, and empowered American citizens to develop the skills needed to contribute and succeed in the changing world economy (Spellings, 2006). Becker (2008) adds support to Secretary Spellings as he states that the training and education graduates receive from universities characterize an investment in the future utilization of the person. Becker asserts that future productivity in the workplace constitutes the realization of the investment in human capital.

According to Becker (1993), "education and training" are considered to be the "most important investments in human capital" (p. 17). The education provided by colleges and universities needs to enhance the value of the student by catering to the specific needs of the marketplace. (Sparks & Waits, 2011). Employment opportunities for workers are increasingly reliant on postsecondary education (Carnevale & Desrochers, 2004). Nazzal and Hillsman (2010) state that collaboration between industry and academia contribute to training environments that benefit students by creating opportunities to use the newfound knowledge and skills of graduates in the workplace. Through collaboration, industry leaders can seize the opportunity to observe the type of research taking place on university campuses, as well as look for emerging avenues of discovery (Nazzal & Hillsman).

The technological workplace of tomorrow depends on the high school and college educational systems of today (Becker, 1993). Money paid to provide on-the-job training is comparable to the investment being made in preparing graduates for the workforce via higher education (Becker, 1993). Reliance upon on-the-job training is needed to close the gap created by the lapse in education college graduates experience coming out of school (Becker, 1993). Factors like "globalization, innovation, and competition" cause companies to quickly become irrelevant, thus progressively changing the jobs graduates expect to fill (Baumol, 2007; Sparks & Waits, 2011, p. 7). Institutions of higher education must collaborate with industry leaders to "offer real-world curricula to ensure that the skills being taught are precisely those that the industry needs" (Sparks & Waits, p. 17).

3. Methodology

The research question used in this study was what characteristics are important for collaboration between academic institutions and workforce leaders to address the gap in skills between what graduates received and what industry leaders expect? The research plan consisted of a case study using observations, interviews, document analysis, and artifacts consistent with an academia-industry partnership working to meet the requirements of a selected STEM field. The review of literature provided the foundation for the problem statement and theoretical framework. The research plan for the study involved collecting, analyzing, and interpreting the data to answer the research question.

The site-selected site was a technical college located in a southeastern United States community that collaborated with a local industry to meet the growing workforce needs for graduates in a STEM field. Per the NSB (2007) National Action Plan for addressing important strategies for success in addressing STEM needs, the specific criteria used for selecting the site consisted of the following:

1. Student preparation for entry into a STEM fields
2. Formal internship program consistent with a written agreement between the STEM-related industry and academic institution
3. College training/education addressed a STEM-field in demand by industry

The academic program selected was an Aircraft Structural Technology (AST) program consisting of 15 classes where graduates of the program were awarded Associate Degrees. After the first 3 semesters (eight classes) students were eligible to compete for a paid internship with a local aerospace company that collaborated with the college. The industry and college signed a Memorandum of Understanding (MOU) to collaborate on the training and education of students so that graduates possessed the skills the industry needed upon graduation. The program had been in place less than a year and at the time had three students participating in the internship. There were currently 97 students enrolled in the AST program and that number was represented a decrease from over 350 in previous semesters. The college had primary and alternate sites, and the industry location was within 20 miles of the college sites. The population studied consisted of students and college faculty/administrators from the selected college, and STEM industry leaders affiliated with the partnership. The sample from the original population consisted of industry leaders, college faculty/administrators, and students involved in the AST program.

4. Data

Data was collected using one-on-one interviews and focus groups. Interviews were semi-structured consisting of open-ended questions in which notes were recorded by digital audio recording and transcription. An interview protocol was developed for students, faculty/administrators, and STEM industry leaders.

The researcher also gathered notes as a non-participant observer. Observations were conducted at the workforce and college sites to collect additional information on the processes used to determine industry needs and ensure the academics were designed to meet the identified needs. Notes were also collected at any meetings where prior approval had been granted. Observations also occurred on the grounds of the industry site as well as in student work areas at the college.

The researcher conducted document analysis by collecting handouts from meetings attended, as well as recording detailed notes on written agreements that formally identified the characteristics of the academia-industry partnership. The researcher also asked for access to any other pertinent documents that identified the expectations, roles, and responsibilities of stakeholders involved in the academia-industry partnership. The researcher asked for and received permission to read applicable private and public documents related to the processes that pertain to the selected academia-industry partnership, and recorded notes on the documents as permitted. Some documents were web-based while others were stand-alone and included information from the college website, online press releases, handouts, and brochures. College and industry promotional materials used for advertising the partnership were also analyzed.

Finally, artifacts in the form of Joint Photographic Experts Group (JPEG) images were also collected by the researcher. Artifacts collected consisted of images at the college and industry locations. JPEG images were taken of tools and equipment used to educate and train students that participated in the partnership. Advance permission was received by the researcher prior to collecting any JPEG images.

5. Results

Research study participants consisted of one industry leader affiliated with the partnership, five students in the academic phase of the program, one student in the internship phase of the program, and two administrator/faculty members, resulting in two interviews and two focus groups. Observations occurred at three sites. Document analysis was conducted on nine documents and 21 artifact items in the form of JPEG still photographs were collected.

The findings address the results of the interviews, focus group, artifacts, observations and document analysis. Characteristics of the academia-industry partnership resulted from the themes identified from each data source and researched area. Content analysis of the interviews and focus groups began by transcribing the audio and performing a line-by-line coding of the data to identify and organize the general themes associated with the partnership. Initially, 89 codes were identified from the interviews and focus groups. Of the initial 89 codes, 22 codes occurred in all four transcripts and guided the development of the major themes. An additional six codes appeared in three of four transcripts, and two codes appeared in two of four transcripts, further adding to the creation of the major themes.

Furthermore, content analysis was also conducted on the observations, artifacts, and documents, to support the major themes identified in the focus groups/interviews. The five major themes that formed the basis for addressing the research question and identifying the characteristics of the academia-industry partnership are as follows:

5.1. Technical Hands-on Training and Education Responsive to Local Industry Needs

Stakeholders in the partnership (industry leaders, college, students) expressed the importance of technical academic classes coupled with hands-on experience. The college embraced the goal of equipping students to meet local industry needs. Observations at the college and at the industry site displayed the importance of a seamless transition from the college to the workplace environment by using similar tools and equipment.

The secondary college site also displayed a commitment to technical hands-on training by allowing students to complete projects in workshops containing authentic aircraft parts. The college's investment in workspace, equipment, and tools equipped students to learn the skills needed in an environment consistent with the workplace. Stakeholder commitment to specialized education and skills-based technical training supported a coordinated transition between the school and work environment.

5.2. Written Formal Agreement with Clear Roles and Responsibilities for Each Stakeholder

A written formal Memorandum of Understanding (MOU) was developed to state the expectations and roles for each stakeholder. The MOU detailed the objectives of the partnership as well as specific responsibilities and roles for each entity, including the curriculum for the college, expectations for the internship student, and pay and schedule requirements for the employer. The MOU constituted formal documentation of the partnership and required the signatures of the industry site General Manager and the college's Vice President for Academic Affairs to make it official.

Stakeholder needs vary within the partnership. Leaders at the college were focused on educating and developing students so that they graduate with the degrees and certifications needed to excel in the workforce. Students sought marketable skills that would enhance their ability to secure future employment. The industry focused on hiring competent workers who would support the company's goals. The formal agreement was crafted so that each stakeholder's needs were appropriately addressed. A written formal agreement also created an atmosphere of accountability that encouraged each stakeholder to adhere to the terms of the MOU.

5.3. Involved, Experienced, and Competent Leadership and Oversight

Faculty at the college was perceived by the students as being professional and competent. Some instructors had decades of experience in the field of aircraft structures. Faculty members served as mentors to the students and were described as being motivated and excited about the field. Students saw administrators and faculty members as instrumental in helping them secure paid internships and eventual full-time employment. Specifically, students expressed excitement about having the AST curriculum include an employment class that focused on practicing interviewing techniques as well as preparing resumes.

The partnership received oversight from advisory committees at the industry and college sites. Short chains of command were utilized to deal with issues and problems. The College Vice President was accessible to faculty members through the Career Services office and the industry General Manager offered a direct line of communication to the site supervisor. Direct access to leaders at each organization contributed to swift problem resolution.

5.4. Communication Ease based on Proximity, Integrity, and Relationships

Proximity, integrity, and a priority on relationships were key characteristics of the communication between the college and industry leaders. The simplicity and ease of communication were described as very positive elements of the relationship, as the ability to make a phone call, conduct a face-to-face visit, or send a simple email allowed for prompt resolution of problems. Each stakeholder viewed integrity and trust as important elements for effective communication.

Feedback to the college from the students allowed graduates to provide information to administrators and faculty related to their training and educational experience. Student recommendations were provided to the internship supervisor by the college, including student work ethic grades. Additionally, the college sought feedback from employers after they hired graduates. Particularly impressive was the warranty statement that the college issued regarding students that were found to be deficient in skills. The college promised to retrain the student at no cost to the employer or the graduate for a period of two years following graduation.

5.5. Economy-based Vulnerabilities and Growing Pains

Participation in the partnerships was viewed by the students as a path to a career. Students also saw that the college provided more than just employment opportunities, but also provided a place for graduates to obtain future certifications and licenses for job advancements. Securing future employment was important to the college and industry leaders, as well as to the students. Faculty observed that co-op/internship opportunities were not as plentiful for students as they had been in the past. The industry leader also noted that full-time employment slots were limited due to the downturn in the economy. Students were frustrated that graduates that preceded them were continuing to experience difficulty in finding jobs. The college also saw evidence of struggling enrollment as the number of students assigned to the AST program had slipped from 350-plus students in previous semesters to a current enrollment of 97.

The partnership also experienced other challenges as well. Faculty sought information on technical specifics contained in proprietary industry documents, but had not yet determined how to access the needed information. Faculty believed that PowerPoint briefings could be constructed in the future to cover the needed information, and these briefings would be useful tools to better prepare students academically.

Resolving this challenge would be beneficial to the industry leaders, college, and students. The industry leader also stated that he could not assess the success of the partnership until the co-op students successfully completed their one-year internship. Intern students also expressed frustration with information they received regarding their pay scale and the amount of money they were required to pay for their initial set of shop tools.

6. Conclusion

An intentional investment in human capital by college and industry leaders is essential to connect student education and training with the needs of the workforce. This is especially true regarding STEM fields as literature suggests STEM skills will continue to be an important part of the global workplace of the future (NSF, 2010). The findings in this study answered the research question by revealing the important characteristics in a STEM-based academia-industry partnership focused on the gap in skills between what STEM graduates get from a college education and what industry leaders expect from college graduates entering the workforce.

The T.W.I.C.E. acronym is an easy way to recall the first word for each characteristic identified in this case study of an academia-industry partnership to support industry STEM needs. The letters in the acronym represent the following five characteristics:

1. **T**echnical Hands-on Education and Training Responsive to a Local Industry Need
2. **W**ritten Formal Agreement with Clear Roles and Responsibilities for Each Stakeholder
3. **I**nvolved, Experienced, and Competent Leadership and Oversight
4. **C**ommunication Ease based on Proximity, Integrity, and Relationships
5. **E**conomy-based Vulnerabilities and Growing Pains

In response to the results of this study, college educators should communicate with local industry leaders to gain a more complete picture of the STEM needs required for entry-level jobs. After gaining an understanding of industry needs, college educators should identify the role the college can play to assist in meeting those needs and create formal written agreements to define the roles and responsibilities for each stakeholder. College leaders should identify dedicated faculty and staff to oversee and lead the partnership development. Face-to-face communication channels should be formed by attending chamber of commerce or economic advisory meetings. Additionally, college educators should be flexible in their program offerings and be responsive to economic changes to ensure the program of study continues to meet the industry requirements.

6.1. Benefits for Higher Education Institutions

Higher education institutions such as the one in this study could potentially benefit from the partnerships if graduates elect to pursue additional licenses and certifications to qualify for future job advancements. Colleges could also benefit by being able to use the paid internship as an incentive for students to enter collaborative programs of study. Students in the AST program for this study realized their future employment potential as well as the role that financial gain played in their course of study selection. Higher education institutions like the one in this study also stand to leverage the resources of the participating industry for the benefit of student's education and training. The combined effect of using industry and college resources also helped students become familiar with equipment and tools used by the industry as well as gain familiarity with the environment and culture at the workplace site.

6.2. Benefits for Higher Education Students

The academia-industry collaboration provided opportunities for students to earn degrees, certifications, majors, minors, and options applicable to industry needs. The additional credentials could also be added to resumes for employment or job advancement. Students in the partnership were prepared to contribute to the STEM workforce in practical ways during their employment. Graduates of the program were also able to leverage the personal and professional relationships they had with administrators and faculty to help them find employment. Participation by the industry leaders in the partnerships gave students the confidence that they were preparing for actual industry needs, potentially reducing their anxiety about securing jobs after graduation. In the end, students possessed the training and education for a skill that could immediately be applied to help meet workforce needs.

6.3. Benefits for Industry

Industry leaders that participated in the academia-industry partnership in this study actively contributed to the development of a more competent pool of employee prospects to hire from.

Throughout the co-op/internship, industry leaders obtained first-hand knowledge of the work ethic and skills of the participating students as they were able to observe the students for one-year prior to hiring them for full-time employment. Industry leaders also participated in a relationship with college leaders that could prove to be instrumental in supporting additional research needs. Industry leaders also have the opportunity to provide real-time updates to the college that address the changing needs of the workplace. Additionally, the collaborative relationship between local industry and the college can serve as an education and training resource for future business development efforts for emerging industry and fields looking to move into the local community.

References

Baumol, J., Litan, R., & Schramm, C. (2007). *Good capitalism, bad capitalism, and the economics of growth and prosperity.* Yale University Press.

Becker, G. (1993). *Human capital: A theoretical and empirical analysis with special reference to education* (3rd edition). Chicago, IL. The University of Chicago Press.

Becker, G. (2008). *Human capital. The concise encyclopedia of economics.* Library of Economics and Liberty. Retrieved from http://www.econlib.org/library/Enc/ HumanCapital.html

Bok, D. (1990). *Universities and the future of America*. Durham, NC: Duke University Press.

Bollinger, L. (2003, October 15). The idea of a university. *The Wall Street Journal*.

Bourdieu, P. (1984). *Distinction: A social critique of the judgment of taste.* R. Nice (Trans) Cambridge, MA: Harvard University Press.

Buck-Morss, S. (2003). *Thinking past terror: Islamism and critical theory on the left*. London: Verso.

Carnevale, A. P., & Desrochers, D. M. (2004). Why learning? The value of higher education to society and the individual, *Keeping America's promise: A report on the future of the community college*, 39-45.

Crouch, C., Finegold, D., & Sako, M. (1999). *Are skills the answer?* Oxford University Press.

Emery, K., & Ohanian, S. (2004). *Why is corporate America bashing our public schools?* Portsmouth, NH: Heinemann.

English, F. (2010). *The ten most wanted enemies of American public education's school leadership*. Retrieved from the Connexions website: http://cnx.org/ content /m34684/1.4/

Feldbaum, M. (2009). Going green, The vital role of community colleges in building a sustainable future and green workforce, *National Council for Workforce Education and the Academy for Educational Development.* Retrieved from http://www.greenforall.org /resources/going-green-the-vital-role-of-community-colleges-in-building-a-sustainable-future-and-a-green-workforce

Felix, A., & Pope, A. (2010). The importance of community colleges to the tenth district economy. *Economic Review, 95*(3), 69-93.

Giroux, H. (2004). *The terror of neoliberalism: Authoritarianism and the eclipse* of *democracy.* Boulder, CO: Paradigm Publishers.

Giroux, H. A. (2005). The terror of neoliberalism: Rethinking the significance of cultural politics. *College Literature, 32*(1), 1-19.

Harvey, D. (2009). *A brief history* of *neoliberalism.* Oxford, UK: Oxford University Press.

Kumashiro, K. (2008). *The seduction* of *common sense: How the right has framed the debate on America's schools.* New York: Teachers College Press.

Ladson-Billings, G., & Tate, W. F. (1995). Toward a critical race theory of education, *Teachers College Record 97*(1) 47-68.

Harkavy, I. (2006). The role of universities in advancing citizenship and social justice in the 21st century. *Education, Citizenship and Social Justice, 1*(1), 5-37.

Hogarth, T., & Wilson, R. (2001). *Skills matter: A synthesis of research on the extent, causes, and implications of skill deficiencies.* Retrieved from http://www2. warwick.ac.uk/fac/soc/ier/publications/2001/hogarth_and_wilson_2001_synthesis.pdf

Mourshed, M., Farrell, D., & Barton, D. (2012). *Education to employment: Designing a system that works.* McKinsey and Company, London. Retrieved from http://mckinseyonsociety.com/downloads/reports/Education/Education-to-Employment_FINAL.pdf

Nair, C., Patil, A., & Mertova, P. (2009). Re-engineering graduate skills: A case study. *European Journal of Engineering Education, 34*(2), 131-139.

National Academy of Sciences (NAS). (2005). *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, DC: The National Academies Press.

National Science Board (NSB) (2007). *A national action plan for addressing the critical needs of the U.S. science, technology, engineering, and mathematics education system.*(NSB-07-117). Retrieved from http://www.nsf.gov/nsb/ documents/2007/ stem_action.pdf

National Science Foundation (NSF). (2010). Preparing the next generation of STEM innovators: Identifying and developing our nation's human capital.*NSB-10-33*. Retrieved from http://www.nsf.gov/nsb/publications/2010/nsb1033.pdf

Nazzal, D., & Hillsman, C. (2010). Better together. *Industrial Engineer: IE, 42*(9), 26-30.

Peters, M. A., & Fitzsimons, P. (2001). "Neoliberalism and social capital: Re-inventing community." *Sites: A Journal for South Pacific Cultural Studies, 37*: 32-48.

Robbins, L. (1963). Great Britain Committee on Higher Education. *Higher education: report / of the Committee appointed by the Prime Minister under the chairmanship of Lord Robbins, 1961-63.* H.M.S.O., London.

Schwegler, S. J. (1982). *Academic freedom and the disclaimer affidavit of the national defense education act: the response of higher education*. Dissertation: Teacher's College, Columbia University.

Sparks, E., & Waits, M. J. (2011). Degrees for what jobs? Raising expectations for universities and colleges in a global economy. *Report by the National Governors Association's Center for Best Practice.*Retrieved from http://www.nga.org/Files/ pdf/1103DEGREESJOBS.PDF

Spellings, M. (2006). *A test of leadership [electronic resource]: Charting the future of U.S. higher education.* A report of the Commission appointed by Secretary of Education Margaret Spellings U.S. Dept. of Education, Washington, D.C.

Tamkin, P. (2005). *The contribution of skills to business performance*. Brighton, Institute for Employment Studies.