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Industrial Attachment in Polytechnic Education: An Approach to Polytechnic-Industry Nexus in Human Capital Development of Selected Polytechnics in Ghana

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Abstract
The institution of industrial attachment in polytechnic education is significant. Industrial attachment underpinned by experiential learning is most appropriate option to enhancing polytechnic-industry nexus in the development of technically skilled and productive human capital potentials for the world of work. However, the polytechnic-industry collaboration in human capital development is hampered by inadequate educational infrastructure, logistics, funding for laboratories, workshops and industrial attachment supervision as well as poor Information Communication Technology (ICT) development. The objective of the paper is to examine industrial attachment in polytechnic education as an approach to polytechnic-industry nexus in human capital development. Mixed method and explanatory research designs were employed in conducting the study. Purposive, simple random and systematic sampling techniques were adopted in selecting a sample of 594 respondents. Survey and interviews were adopted as methods of data collection. Instruments such as questionnaire, interview guide, and focus group discussions were used in collecting data. Descriptive and inferential statistics were employed in data processing and analysis. The polytechnic-industry collaboration is weak. It is limited to sharpening of lecturer's skills, practical training for students and the drafting and review of polytechnic curriculum. The relatively weak linkage were in joint research, provision of teaching and learning materials, funds for research, and the use of industry executives as guest lecturers. The Conference of Rectors of Polytechnics and Chief Executive Officers of industries should establish sustainable collaborative structures to enhance the nexus between polytechnics and industry in the development of productive and technically trained human capital in Ghanaian polytechnics.
Keywords: Polytechnic-industry nexus, polytechnic education, human capital development, industrial attachment, experiential learning, selected polytechnics in Ghana

1. Introduction

Development is a process of change in the quality of living (Kendie & Martens, 2008) underpinned by improvement in the well-being of people. Technical and vocational education and training (TVET) has been acknowledged as a veritable strategy of facilitating socio-economic growth and development in Ghana. In realising this educational philosophy, the educational system of Ghana was reformed in 1987 and 2007. Indeed, the University Rationalization Committee (URC) white paper specifically stated that the polytechnics have a distinct and important role to play in middle-level manpower development and that programmes and courses were to be offered at the middle-level of technical training leading to the award of higher national diplomas but not departing from syllabi dedicated to practical training. The provision of such programmes will complete the cycle of technical education and provide a capacity for higher level technician training and practical research (Ministry of Education, 1993). This resulted in the enactment and promulgation of the Polytechnic Law of 1992, PNDC Law 321 to established polytechnics as tertiary institutions (GoG, 1992; Kwami, 2001). However, the law establishing the polytechnics in Ghana was revoked and replaced by the Polytechnic Act, 2007, Act 754 in order to clarify the objective of polytechnic education in the provision of tertiary education that is career focused, to prepare students for middle-level supervisory and managerial positions in business and industry in Ghana. Similarly, the educational strategic plan for tertiary education (2010-2020) is being adopted to provide equitable tertiary education for all eligible, to place emphasis on science and technology and national needs, to expand tertiary education to include open university and new universities, to strengthen links between tertiary education and industry in order to promote and review academic programmes and research relevant to national development in collaboration with the private sector, and to undertake consultation with the private sector particularly industry. This is meant to identify pertinent areas for research and development. The strategic plan also seeks to promote science and technical education at the tertiary level by ensuring that tertiary graduates have appropriate broad skills for future study and work. It is also to update ICT and skills components and making them available and a normal part of tertiary coursework and to national needs (Government of Ghana, 2012).
The polytechnic law provided polytechnics with autonomy and mandate to provide tertiary education through full time courses in the field of manufacturing, commerce, science, technology, applied social science, applied

arts and such other areas as may be determined by the authority for the time being responsible for higher education; to encourage studies in technical subjects at tertiary level; and to provide opportunity for development, research and publication of research findings. Accordingly, Kwami (2001) describes polytechnics as technological institutions with the responsibility of contributing actively to national development by providing career-focused education and skills training to the highest level possible and providing opportunities for applied research in close collaboration with business and industry. In this regard the mission of polytechnics in Ghana is ‘‘to provide high calibre career-focused middle-level technical personnel, possessing knowledge-based modern skills for various sectors of the economy. For industry, they are crucial for transforming knowledge and ideas into goods and services through productive progress. They are needed to ensure and sustain efficient productivity in industry” (Kwami, 2001 p.16).

Fundamentally, the essence of polytechnic education is to run career-centred and more practically oriented programmes. Most of the polytechnics in Ghana, train students in at least three of the following faculties such as applied science, business and management studies, creative or applied arts, engineering, entrepreneurship and medicine and health science. This is to inculcate and develop highly knowledgeable and technically skilled middle-level human capital with productive and employable skills, attitudes and competencies required in industry and the world of work (GoG, 1992; Kwami, 2001; Amankwah, 2011). Indeed, the key development objectives of the Ghana Industrial Policy (GIP) are to expand productive employment in the manufacturing sector, to expand technological capacity in the manufacturing sector, to promote agro-based industrial development and to promote spatial distribution of industries. However, challenges of the industrial sector of Ghana relate to technical skills in specialised areas such as oil and gas and manufacture of capital goods. For instance, there is the lack of adequately trained manpower in oil and gas production and capital goods manufacture is a constraint to the growth of these sectors. The availability of such personnel in these key sectors is an essential pre-requisite for industrial development. Hence, adequate skilled manpower and high labour productivity are critical (Yawson, 2014). This is where polytechnic education is imperative.

Significantly, for the purposes of realising the whole essence and objective of polytechnic education in human resource development, it is imperative for students and senior members to acquire both theoretical and practical knowledge and technical skills. This can be accomplished through institutional support and collaboration as well as polytechnic-industry linkage. With regard to institutional support and collaboration, a number of key institutions including the Ministry of Education (MoE), National Council for Tertiary Education (NCTE), National Accreditation Board (NAB), National Board for Professional and Technician Examinations (NABPTEX), and Council for Technical Vocational Education and Training (COTVET) have been set up to coordinate the activities of technical institutions including the polytechnics. This is to ensure quality of programmes and award of degrees and diploma certificates to students and to ensure good governance. Similarly, competency-based training and industrial attachment have been introduced and instituted in the polytechnics as a significant step and conduit of enhancing students’ and senior members’ technical knowledge, productive skills, competencies, attitudes and abilities essential for the world of work.

Industrial attachment is a practical skill training enterprise designed to bridge the gap between the theoretical world of academic enterprise and the world of work of professional practice (Lauber, Ruth, Theuri & Woodlock, 2004). It is a process of anticipatory socialisation where participants engage with industry to observe, learn, experiment and put theory into practice in order to acquire technical knowledge, productive and innovative skills, competencies, attitudes and abilities necessary for the world of work. The industrial attachment programme based on experiential learning approach has been perceived by stakeholders as a catalyst to human resource development in Ghanaian public polytechnics. It serves as a perfect transition from the classroom to the world of work by developing students’ job related skills, and enhancing job placement opportunities, as well as developing the problem solving, communication and human relations skills of students (Ayarkwa, Adinyira & Osei-Asibey 2012; Adjei, 2013). It also enhances polytechnic-industry relationship, integrates practical experience with theory, builds students’ professional confidence level, and bridges the gap between classroom and world of work. Similarly, it serves as a source of recruiting and selecting new employees, injecting new ideas into an organisation, and developing industry support for polytechnic programmes (Adjei, Nyarko, Nunfam, 2012; Adjei, 2013; Adjei, Nyarko & Nunfam, 2014).

Notwithstanding the significance of the industrial attachment programme in polytechnics in Ghana, empirical studies have showed that the linkage between the polytechnics and industry in the training and education of students and improving the capacity of staff on current innovations in the field of manufacturing, commerce, science, technology, applied arts and applied social sciences through industrial attachment is weak (Akomaning, 2007; Mensah, 2008; Nkrumah, Apori & Adjei, 2011; Ayarkwa, et al., 2012; Adjei et al., 2012; Adjei, 2013). The snag is due to the key challenges of polytechnics in relation to inadequate staff development, inadequate infrastructure, weak financial position of students, inadequate logistics (transport facilities, office equipment, teaching and learning materials, and stationery), unsatisfactory condition of service, inadequate funding for laboratories, workshops and industrial attachment supervision, as well as poor Information

Communication Technology (ICT) development (Takoradi Polytechnic, 2011; Kumasi Polytechnic, 2012; Tamale Polytechnic, 2012; Accra Polytechnic, 2013). This has resulted in the present challenge of the polytechnics to effectively collaborate with industry in order to put theoretical lessons into practice in industry, discover new knowledge and innovations through research, produce entrepreneurial and employable graduates in the areas of manufacturing, commerce, science, technology, applied arts and applied social science. The continued existence of these problems has the potential of hindering the achievement of the objectives of polytechnic education in relation to competency-based training and the industrial attachment programme in particular. Similarly, industry is concerned that polytechnic education seem to lay more emphasis on theory, but less on hands-on practice and technical report writing. There are also issues of lack of innovation research and development, lack of correlation between theory and world of work, short duration of industrial attachment, inadequate institutional supervision, and competition between vacation industrial programme (VIP) and/or industrial attachment programme (IAP) and Ghana National Service Scheme (GNSS) (Yawson, 2014) and labour unrest.

Considerably, in the face of the challenges of polytechnics and industries, industrial attachment based on experiential learning as an approach to polytechnic-industry collaboration in human capital development is fundamental to polytechnic education, industrial productivity and growth as well as national development. It was therefore of the essence to examine the extent of collaboration between the polytechnics and industry as an approach to human capital development in Ghanaian polytechnics. The objective of the paper is to examine industrial attachment in polytechnic education as an approach to polytechnic-industry nexus in human capital development in Ghana. The study also sought to test the following hypotheses:

1. **Ho**: There is no significant difference in polytechnic-industry nexus in human capital development in polytechnic education among four stakeholders (senior members, students, industry, and professional associations).
   Hi: There is a significant difference in polytechnic-industry nexus in human capital development in polytechnic education among four stakeholders (senior members, students, industry, and professional associations).
2. **Ho**: There is no significant difference in polytechnic-industry nexus in human capital development in polytechnic education among four polytechnics (Accra, Kumasi, Tamale and Takoradi).
   Hi: There is a significant difference in polytechnic-industry nexus in human capital development in polytechnic education among four polytechnics (Accra, Kumasi, Tamale and Takoradi).

The paper is organised into six sections including the introduction, theoretical perspectives and conceptual framework. It also presents the methodology, results and discussion on the polytechnic-industry nexus in human capital development and conclusions and recommendations of the study.

2. Theoretical perspectives

2.1. Human capital development

Human capital refers to the stock of productive skills and technical knowledge embodied in labour which serves as a means of production, into which additional investment yields additional output. Organisation for Economic Co-operation and Development (OECD) (1998, p.9), refers to human capital as "the knowledge, skills and competencies, and other attributes embodied in individuals that are relevant to economic activity". Human capital has also been defined as an intangible asset, best thought of as a stock of embodied and disembodied knowledge, comprising education, information, health, entrepreneurship, and productive and innovative skills, that is formed through investments in schooling, job training, and health, as well as through research and development projects and informal knowledge transfers (Ehrlich & Murphy, 2007, p.2).

The theory of human capital operates on the assumption that formal education is highly instrumental and necessary in improving the production capacity of a population. Hence, it accentuates on how education increases the productivity and efficiency of workers by increasing the level of cognitive stock of economically productive human capability which is a product of innate abilities and investment in human beings (Sakamota & Powers, 1995; Psacharopoulos & Woodhall, 1997). The human capital theorists argue that an educated and trained population is a productive population. Therefore, investment in education, training and health of a country could increase its human capital resource base and potential productivity.

Human capital development (HCD) is the process of facilitating improvement in the quality of technical knowledge, productive and innovative skills, competencies, values, attitudes and abilities of people necessary for the world of work. HCD is the process of capacity building and strategic mobilisation of human capital which unlocks the door of modernisation, increases productivity and greater global trade as well as integrates them with the world economies (Kazmi, 2007). It also involves the process of improving on the knowledge, skills and competencies, and other attributes embodied in individuals that are relevant to economic activity. Furthermore, it is the process of improving on the embodied and disembodied knowledge, comprising education, information, health, entrepreneurship, and productive and innovative skills, that is formed through investments in schooling,

job training, and health, as well as through research and development projects and informal knowledge transfers (OECD, 1998; OECD, 2001; Ehrlich & Murphy, 2007). Relative to polytechnic education, human capital development connotes improvement in the technical knowledge, productive capacities and innovative skills, values, attitudes, competencies and abilities of students required for the world of work with specific reference to manufacturing, commerce, science, technology, applied social science, and applied arts.

2.2. Experiential learning theory

Experiential learning is a "direct encounter with the phenomenon being studied rather than merely thinking about the encounter, or only considering the possibility of doing something about it" (Borzak, 1981, p. 9, cited in Brookfield, 1983; Smith, 2005). Proponents of experiential learning have tended to use the term in two contrasting senses (Brookfield, 1983). On one hand, it is used to describe the sort of learning undertaken by students who are given a chance to acquire and apply knowledge, skills and feelings in an immediate and relevant setting. The second type of experiential learning is "education that occurs as a direct participation in the events of life" (Houle, 1980, p.221; Henderson, Napan & Monteiro, 2004). Here, learning is not sponsored by some formal educational institution but by people themselves. It is learning that is achieved through reflection upon everyday experience and is the way that most of us do our learning.

According to Jarvis (1995), experiential learning is about learning from the primary experience, that is, learning through sense experience and which tends to exclude the idea of secondary experience. Similarly, Jarvis (1987; 1995) explains experiential learning by recognising a number of responses to the potential learning situation through the trajectory to experiential learning. These include: non learning, non-reflective and reflective learning. The trajectory of non-learning consists of presumption, non-consideration and rejection. The trajectory of non-reflective learning consists of pre-conscious, practice and memorisation while the trajectory of reflective learning consists of contemplation, reflective practice and experiential learning. However, this model has been criticised based on different cultural experience. There is the need to take account of differences in cognitive and communication styles. The model is too simplistic and has no capacity to measure the degree of integration of learning style (Tenant, 1997). This notwithstanding, the model of Jarvis, provides an excellent framework for planning, teaching and learning activities. It can also be employed as a guide to students in acquiring knowledge and skills by observing practical and expert performance in industry (Tenant, 1997).

3. Conceptual framework

This conceptual framework puts the study in this paper into perspective. It defines the variables measured with regard to polytechnic-industry linkage in using industrial attachment as a means of human capital development. The framework is premised on the trajectory of experiential learning proposed by Javis (1987; 1995). Jarvis highlights a number of responses to the potential learning situation. Using Kolb's model with a number of different adult groups, Jarvis (1987; 1995) developed a model, which allowed different routes of learning: non-learning, non-reflective and reflective learning. It is important to note that Jarvis' (1987; 1995) model of experiential learning was adapted to explain the possible routes of human capital development by students on industrial attachment in Ghanaian polytechnics. It helps to clarify different routes by which student interns can put theory into practice, in order to enhance their skills, competences and abilities required for the world of work. However, the model of Javis, lacked clarity in the sequencing of learning routes and falls into a trap of stage thinking as many things may be happening at once.

Industrial attachment is a formal work experience (hands-on-learning) programme that forms a vital component of the polytechnic curriculum. It is also directly related to the major and career objectives of the student. Considering polytechnic education, the curriculum provides for some practical lessons during the academic year. Meanwhile, the polytechnic student has little or no experience with regard to what actually pertains in the work environment. The student in this regard is, therefore, motivated by both the theory and practical lessons on campus to have a feel at first hand industrial practical experience, in his/her chosen career during the long vacation of three months. The conceptual framework for industrial attachment and human capital development in Ghanaian polytechnics as presented in Figure 1 is adapted for this study. It involves an examination of the activities of the student intern, the polytechnic and industry in the industrial attachment programme of Ghanaian polytechnics as a basis for human capital development (Adjei, 2013).

The framework looks at the contributory role of both theoretical and practical learning in the overall human capital development of the student through polytechnic education. It shows the trajectory to human capital development through industrial attachment. Thus, industrial work experience, following a prior theoretical learning in the classroom, reinforces classroom learning and produces skilled and knowledgeable students with productive and employable skills required for the world of work as indicated by the human capital theory (Jarvis, 1987; 1995; Adjei, 2013).

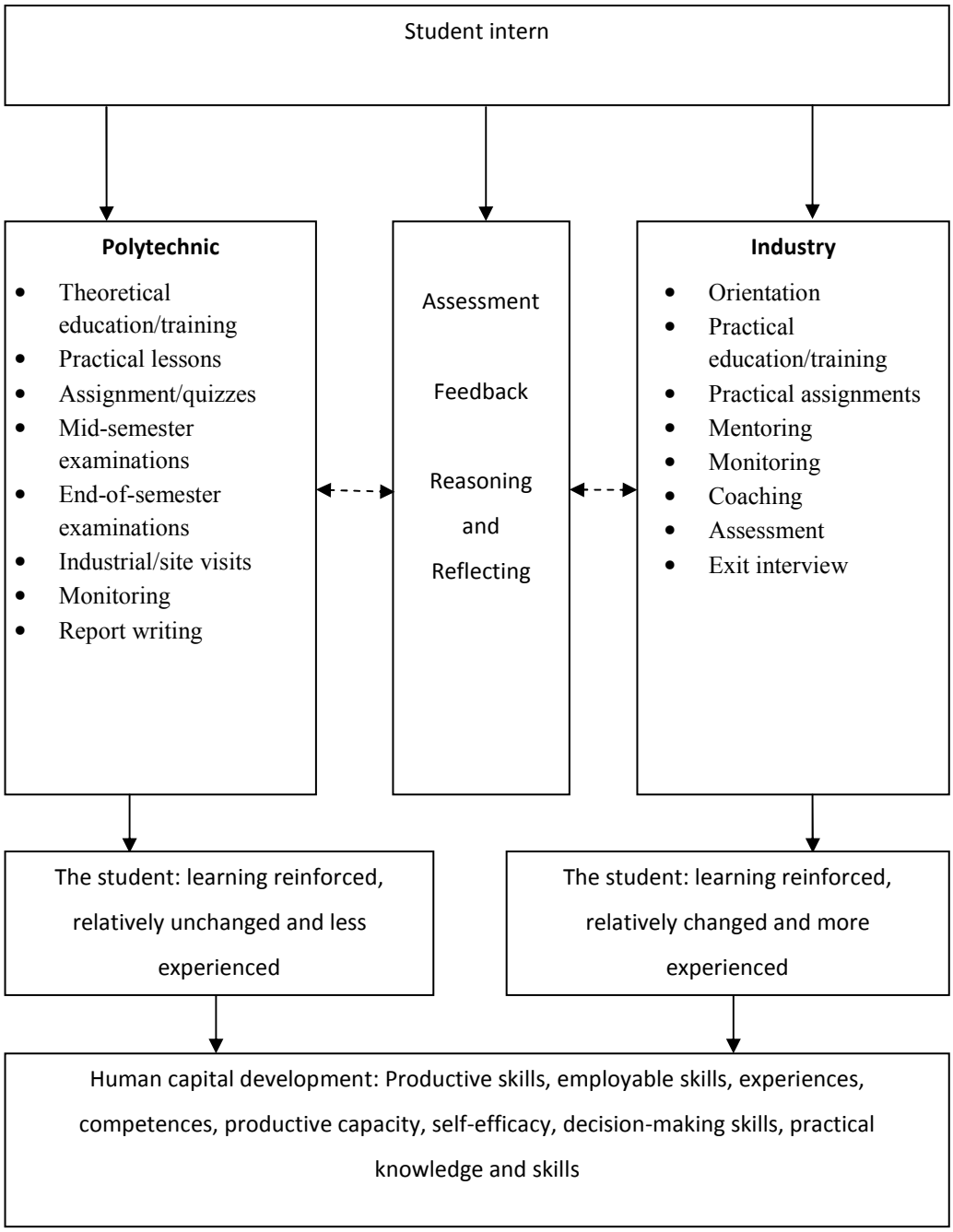

Figure 1: A conceptual framework for industrial attachment
Source: Adapted from Adjei (2013)

Fundamentally, internship exposes students to real work environment and helps apply theory to practice (Ayarkwa et al., 2012). Basically, the first and second year students in the polytechnic begin the process of skills and knowledge acquisition during the course work in the classroom. This stage presents an induction of the students into theoretical fields of his/her chosen career of study. Much of the training at this stage goes with very little practical work since the student is pre-occupied with classroom work and preparation for written assignments and end-of-semester examinations. The training at this point also involves industrial visits, and report writing. This is complemented by practice assignments, whereby the student is given opportunity to put theory into practice in the laboratories and workshops on campus (Adjei, 2013). The characteristics of the student play a significant role in the practical learning process in this regard. This is the way pragmatic knowledge can be acquired (Jarvis, 1995). (Figure 1).

The outcome of these activities in the polytechnic is the development of human capital (productive

skills and employability) as the polytechnic student would have gone through some reinforced learning but relatively unchanged and less experienced (Jarvis, 1995). This is the stage where abstract learning is reinforced or stimulated in terms of what pertains in the world of work. The effect of practice is strengthened with reinforcement, such as receiving a pleasurable consequence (Raj, Nelson & Rao, 2006). This is the stage in polytechnic education where practical insight in terms of the subject matter is obtained and reinforced.

Furthermore, activities at the industry lead to the acquisition of industrial work experience, attitude, and competencies resulting in human capital development. The stage is now set for the student to have a real practical experience of what he/she learned in the classroom on campus. The student enters the industry for attachment with only an imagined picture of what his/her chosen field of study actually entails. However, this imagined picture provides the student intern with the necessary preparatory grounds for the real work experience. Beside the classroom knowledge, the student is given some guidance by the industrial liaison office, in terms of conduct during the attachment. This industrial work experience involves personal observation by the student; instructions and assignments from field or industry-based supervisors; hands-on-learning; periods of question and answer; coaching; mentoring; monitoring and evaluation. This period, therefore, involves a purposive or objective interaction between the student intern and his/her social and physical environment of the work place under the supervision of the industry-based supervisor (Figure 1).

The experiences of the student, based on the activities of the polytechnic and industry, result in the creation of awareness of self and environment. This is the stage where the student intern after each day or work session contemplates or reflects a great deal. The student considers the situation he/she has gone through and makes an intellectual decision about it. Self-appraisal here will lead the student intern to a deeper self and environmental awareness. Evaluation of the student interns is critical for their educational development. It is also a valuable tool for the student's professional improvement (Ronezkowski, LaFollette & Bellingar, 2004). Technical evaluation here is different for each student intern because of differences in site objectives and in the type of work or service offered. For grading purposes, the student's academic work, field work, site and visiting supervisors' evaluation, work ethics, accomplishments, successes and final reports are all considered (Figure 1). Moreover, in the process of the industrial work experience, the skill and knowledge acquisition process is periodically or sporadically monitored and evaluated by both the industry-based supervisor and the visiting supervisor from the polytechnic. The results of the evaluation are discussed first between the supervisors (industry-based and visiting) and then the student intern is brought in, where corrective measures are carried out in terms of performance for the purpose of successful and effective practical training (Adjei, 2013).

Knowledge of results and feedback provides objective information regarding the adequacy of one's performance. In the process of practical industrial attachment, feedback usually spells out the success or otherwise of the student's ability to acquire the related skill or experience of the workplace. Feedback, in this regard, is based on assessment of reports by both industry-based and visiting lecturers, and also from the written reports presented by the student intern after the completion of the attachment. Additionally, knowledge of both self and environment, realities on the ground and continual feedback are meaningful indications that will help the student intern to make an informed decision as to whether he/she has attained a 'fit' or consistency with his/her career choice. This is close to what Schôn (1983) and Frampton and Lenon (2009) described as reflection on and in action.

Essentially, student interns who vigorously undertake both activities have learning reinforced, changed and have become more experienced. Thus, having gone through theory and practice, the polytechnic student is now confident, well equipped and practically oriented to enter the world of work and perform as expected with little or no orientation. In other words, after the first and second years' classroom work, the polytechnic student is expected to have changed and become more experienced and prepared in terms of the requisite skills and knowledge required by the world of work as indicated by the human capital theory. It also helps the student to carry out a personal assessment in terms of person-environment fit or consistency with regard to their chosen careers as emphasised by the career management theory. Productive skills, employable skills, experiences, competences, productive capacity, self-efficacy, decision-making skills, practical knowledge and skills are the anticipated outcomes of the industrial attachment programme based on experiential learning (Adjei, 2013).

4. Methodology

Mixed method research approach and explanatory research design involving both quantitative and qualitative methods were employed for the purposes of triangulation and complementarity. The essence of triangulation is to collect, analyse and seek corroboration between quantitative and qualitative data while complementarity is to use quantitative and qualitative methods to measure overlapping but distinct facets of the relationship and differences in industrial attachment in polytechnic education as an approach to polytechnic-industry nexus in human capital development among stakeholders in a single study (Caracelli & Greene, 1993; Creswell, 2003). The application of multiple sources of evidence in a study helps to have a clearer understanding of the research problem by converging numeric trends from quantitative data and specific details from quantitative data

(Martens, 2003).

The study population consisted of third year students and senior members (lecturers and administrator) from four selected public polytechnics including Accra Polytechnic, Kumasi Polytechnic, Takoradi Polytechnic and Tamale Polytechnic. Members of industries and professional associations who were beneficiaries of the industrial attachment programme were included. Purposive, simple random and systematic sampling techniques were adopted in selecting 594 respondents for the study. Purposive sampling was employed in selecting all beneficiary industries of the industrial attachment programme, from records of the industrial liaison officers of the four polytechnic. Consequently, 85 members of industry who worked directly with students on attachment where purposely selected. Four polytechnics (Accra Polytechnic, Kumasi Polytechnic, Takoradi Polytechnic and Tamale Polytechnic) were purposively selected because they were part of the six polytechnics that were first upgraded to tertiary institutions; placed emphasis on practical training through industrial attachment and were located in the metropolis with concentrations of industries (Takoradi Polytechnic, 2011; Kumasi Polytechnic, 2012; Tamale Polytechnic, 2012; Accra Polytechnic, 2013). Hence, 118 senior members who were directly involved in the planning and implementation of the industrial attachment programme were purposively selected. The systematic sampling technique was adopted in selecting 355 students from a total of 6,718 third year students from the four polytechnics based on the sample size determination method of Krejcie and Morgan (1970). Thirty-six members of professional associations involved in the industrial attachment programme of the polytechnics were also purposively sampled. In all a sample of 594 respondents were selected for the study.

Survey and interviews were adopted as methods of data collection. Instruments such as questionnaire, interview guide, and focus group discussions were used in collecting primary data (Sarantakos, 1998; McBurney & White, 2007). Questionnaires were used for students, senior members, members of industry and professional associations while interview guide was used for key stakeholders (executive officers of industry and professional associations and senior management of the polytechnics). Focus group discussion (FGD) was also held for key stakeholders in the polytechnics and industry.

Descriptive and inferential statistics were employed in analysing both qualitative and quantitative data. Data was processed using Statistical Product and Service Solutions version 16 and presented in tables. ANOVA was employed to determine whether stakeholders significantly differed in their opinions regarding industrial attachment in polytechnic education as an approach to polytechnic-industry nexus in human capital development dimensions at 0.05 significant level and the p-value. The Post Hoc Test was also conducted, using Tukey's Test to determine exactly where the differences among the groups occurred (Pallant, 2005). The results and discussion were presented using the Likert scale, tables, means and percentages.

5. Results and discussion

5.1 Polytechnic-industry nexus in human capital development

The fundamental relationship between educational institutions and industry could be described as reciprocally dependent. Educational institutions, such as the polytechnics and universities, serve as grounds for human capital development by increasing people's employability and productive potential through the provision of knowledge and skills as would be required by industry. Accordingly, in ascertaining the linkage between polytechnics and industries, the study sought the opinions of senior members, students, member of professional associations and industry on the linkage between polytechnics and industry with the view to establish funding and collaborative gaps. Consequently, the following observations were made on the linkage between polytechnics and industry.

5.1.1 Opinion of senior members on polytechnic-industry linkage

On the question of whether industry provided opportunity for polytechnic lecturers to sharpen their skills through industrial attachment, 66.1 percent, out of the 118 respondents of the senior members confirmed that industry gave lecturers the opportunity to sharpen their skills, 10.2 percent were undecided, whilst 23.7 percent answered in the negative (Table 1). The Rector of Takoradi Polytechnic intimated in an interview that, on a number of occasions, Volta Aluminum Company (VALCO) in Tema, provided opportunity for lecturers of the polytechnic to sharpen their skills and knowledge. Such lecturers, after their internship, came back to campus with discarded equipment donated by VALCO meant for teaching and learning.

Table 1: Opinion of senior members on polytechnic-industry linkage

Statement	SA %	A %	U %	D %	SD %
Industry provides opportunity for polytechnic lecturers to sharpen their skills	25.4	40.7	10.2	16.9	6.8
Industry provides opportunity for practical training for polytechnic students	50.0	49.2	0.8	0.0	0.0
Polytechnics carry out joint research with industry to acquire knowledge and experience	9.3	28.0	18.6	31.4	12.7
Industry provides teaching and learning materials to polytechnics periodically	5.1	28.0	18.6	31.4	17.8
Industry provides funds specifically for research in this polytechnic	5.1	11.0	14.4	41.5	28.0
Industry provides sponsorship and scholarships for polytechnic students	5.1	22.0	21.2	32.4	19.5
Industry executives are invited to polytechnics to deliver guest lessons or lectures regularly	7.6	19.5	15.3	43.2	14.4
Industry is involved in the drafting and review of curriculum for polytechnics	21.2	38.1	18.6	13.6	8.5

n=118
Source: Field survey, 2012

With regard to whether industry provided the opportunity for practical training for polytechnic students, it was observed in the study that 99.2 percent answered in the affirmative, whilst 0.8 percent was undecided. It was also observed that industry was involved in the drafting and review of the curriculum for the polytechnics. In this regard, 59.3 percent of the senior members agreed that industry was involved in the drafting and review of the curriculum for the polytechnics, 18.6 percent were undecided, while 22.1 percent disagreed with the view.

However, as to whether polytechnics carried out joint research with industry to acquire knowledge or experience, the study showed that 37.3 percent agreed that polytechnics carried out joint research with industry to acquire knowledge or experience, 18.6 percent were undecided, whilst 44.1 percent of the respondents disagreed. The small number of respondents who agreed that polytechnics carried out joint research with industry to acquire knowledge or experience could be explained by the 26.1 percent of the senior members who answered positively to the assertion that industry provided funds for research in the polytechnics. To the question as to whether industry executives were invited to the polytechnics to deliver guest lessons or lectures regularly, 27.1 percent of the senior members agreed, 21.2 percent were undecided and 57.6 percent disagreed.

5.1.2 Opinion of students on polytechnic-industry linkage

The views of students were also sought on polytechnic-industry linkages. In this regard, to the issue of whether industry provided the opportunity for students of polytechnics to sharpen their skills through industrial attachment, the study revealed that, out of the 355 respondents, majority (56.1%) of the students acknowledged that industrial attachment provided the opportunity to enhance their skills, whilst 13 percent and 33 percent were undecided and answered in the negative respectively (Table 2). The study also sought to find out whether industry provided the required practical training opportunities to polytechnic students who undertook industrial attachment. The results clearly indicated that the majority (91%) of the respondents agreed with the assertion that industry provided practical training opportunities to polytechnic students.

Another point of interest with regard to the link between polytechnics and industry had to do with the use of guest lecturers from industry. The views of the students clearly indicated that 44.8 percent were in support of the statement that executives of various industries were invited to regularly deliver guest lectures in the polytechnics, 12.7 percent were undecided, whilst 42.6 percent answered in the negative. The views of students, so far, indicate that there was some relationship between polytechnics and industry. However, this was limited to industry providing the opportunity for students to undertake practical training, and executives of industry delivering lectures regularly at the polytechnics (Table 2).

Again, the study considered ascertaining whether the current polytechnic- industry linkage resulted in industry providing funds specifically for research in the polytechnics. Consequently, the study revealed that 16.9 percent of the students agreed while the majority (65.1%) disagreed with the view that industry provided funds for conducting research in the polytechnics. A marketing student in Accra Polytechnic hinted in a focus group discussion that the head of Marketing Department sometimes engaged them to collect data for the purpose of research for some communication companies operating in and around the city of Accra. According to the student, because they were paid officially for their services, he held the view that funds were provided by some industries

for research. This was corroborated by a mathematics and statistics student in a similar focus group discussion in Takoradi.

The last issue of interest considered in ascertaining the views of students in relation to the linkage between polytechnics and industry was on the participation of industry in drafting and reviewing the curricula for polytechnics. The results of the study indicated that 31.5 percent of students were of the view that industry participated in the drafting and review of curricula for polytechnics, 23.7percent were undecided, while 44.8percent answered in the negative.

Table 2: Opinion of students on polytechnic-industry linkage

Statement	SA %	A %	U %	D %	SD %
Industry provides opportunity for polytechnic students to sharpen their skills	27.6	28.5	13.0	20.0	11.0
Industry provides opportunity for practical training for polytechnic students	54.1	36.9	2.0	3.7	3.3
Polytechnics carry out joint research with industry to acquire knowledge/experience	23.4	32.1	12.7	20.8	11.0
Industry provides teaching/learning materials to polytechnics periodically	7.0	19.2	15.8	34.1	13.9
Industry provides funds specifically for research in this polytechnic	8.2	8.7	18.0	33.0	32.1
Industry provides sponsorship and scholarships for polytechnic students	9.3	19.7	20.6	25.0	25.4
Industry executives are invited to polytechnics to deliver lessons/lectures regularly	11.8	33.0	12.7	25.1	17.5
Industry is involved in the drafting and review of curriculum for polytechnics	9.0	22.5	23.7	24.2	20.6

n=355
Source: Field survey, 2012

5.1.3 Opinion of members of professional associations on polytechnic-industry linkage

The opinions of professional associations were equally important in ascertaining the state of polytechnic-industry linkage. For this reason, the study sought the views of professional associations as to whether industry provided opportunity for polytechnic lecturers and students to sharpen their skills. The study showed that out of the 36 respondents, 63.9 percent responded positively, 5.6 percent remained neutral, while 30.5 percent answered in the negative.

Furthermore, to the question as to whether industry provided opportunity for practical training for polytechnic students, the results of the study indicated that 16.7 percent of the respondents answered in the affirmative. However, the majority (83.3%) had contrary opinion that industry provided the opportunity for polytechnic students to undergo practical training (Table 3).

Additionally, the study sought to ascertain the linkage between industry and polytechnics in terms of collaborative research for knowledge acquisition and sharing of experiences. The majority (66.6%) of the members of the professional associations answered in favour of the assertion that polytechnics and industry collaborated in undertaking research for the acquisition of knowledge and sharing of experiences, 11.1 percent were undecided, while 22.3 percent answered in the negative.

The study also wanted to ascertain whether the current linkage between industry and polytechnics involved situations where industry provided financial support for research in polytechnics. In this regard, it was observed that 75.0 percent of the respondents answered in the affirmative, 5.6 percent were undecided, while 19.4 percent of the respondents did not agree with the view that industry provided funds specifically for research in polytechnics (Table 3).

Table 3: Opinion of members of professional associations on polytechnic-industry linkage

Statement	SA %	A %	U %	D %	SD %
Industry provides opportunity for polytechnic lecturers to sharpen their skills	27.8	36.1	5.6	16.7	13.8
Industry provides opportunity for practical training for polytechnic students	16.7	0.0	0.0	22.2	61.1
Polytechnics carry out joint research with industry to acquire knowledge/experience	30.5	36.1	11.1	16.7	5.6
Industry provides teaching/learning materials to polytechnics periodically	19.4	44.4	11.1	11.1	14.0
Industry provides funds specifically for research in this polytechnic	25.0	50.0	5.6	11.1	8.3
Industry provides sponsorship and scholarships for polytechnic students	5.6	36.1	16.6	30.6	11.1
Industry executives are invited to polytechnics to deliver lessons/lectures regularly	5.5	25.0	27.8	41.7	0.0
Industry is involved in the drafting and review of curriculum for polytechnics	0.0	19.4	13.9	61.1	5.6

n=36
Source: Field survey, 2012

The study sought to ascertain the position of members of professional association on the participation of industry in drafting and review of curricula for the polytechnics. The study showed that 19.4 percent agreed, and 13.9 percent were indifferent, whilst the majority (66.7%) disagreed with the statement that members of professional associations participated in the drafting and review of curricula for polytechnics.

5.1.4 Opinion of members of industry on polytechnic-industry linkage

It was important to ascertain the position of industry on the linkage between polytechnics and industry. To this end, the results of the study showed that, out the 85 respondents, 65.9 percent agreed that industry provided the opportunity for polytechnic lecturers to sharpen their skills, 14.1 percent were indifferent, whilst 20.0 percent disagreed. Again, to the question as to whether the polytechnic-industry linkage involved industry providing opportunities for polytechnic students to undertake practical training, the results of the study revealed that the majority (92.9%) of the respondents answered in the affirmative, while 5.9 percent were indifferent to the view that industry provided opportunity for practical training for polytechnic students (Table 4). In expressing his opinion on industrial attachment, the Human Resource Manager (HRM) of Takoradi Flour Mills stated that:

> The linkage between the polytechnics and industry is a means of exposing students and staff of the polytechnics to practical realities in the world of work that would equip students with the needed practical skills to complement theory with practice.

In addition, the study sought to find out from the members of industry the relationship between the polytechnics and industry as to whether polytechnics and industry carried out joint research work in order to acquire and share knowledge and experiences. In this regard, the study indicated that 41.2 percent of the members answered positively to the statement that polytechnics carried out joint research with industry to acquire knowledge/experience, while 24.7 percent and 34.1 percent were undecided and disagreed to the statement respectively.

Table 4: Opinion of members of industry on polytechnic-industry linkage

Statement	SA %	A %	U %	D %	SD %
Industry provides opportunity for polytechnic lecturers to sharpen their skills	21.2	44.7	14.1	10.6	9.4
Industry provides opportunity for practical training for polytechnic students	54.1	38.8	5.9	1.2	0.0
Polytechnics carry out joint research with industry to acquire knowledge/experience	15.3	25.9	24.7	23.5	10.6
Industry provides teaching/learning materials to polytechnics periodically	4.7	25.9	29.4	23.5	16.5
Industry provides funds specifically for research in the polytechnic	3.5	16.5	31.8	32.9	15.3
Industry provides sponsorship and scholarships for polytechnic students	7.1	31.8	28.2	18.8	14.1
Industry executives are invited to polytechnics to deliver lessons/lectures regularly	8.2	30.6	24.7	24.7	11.8
Industry is involved in the drafting and review of curriculum for polytechnics	4.7	15.3	28.2	29.4	22.4

n=85
Source: Field survey, 2012

Furthermore, the study investigated the relationship between the polytechnics and industry by seeking the views of members of industry on whether industry provided teaching and learning materials to polytechnics periodically. The results indicated that 30.6 percent of the respondents answered in the affirmative, 29.4 percent were neutral, while 40.0 percent answered in the negative. Indeed, in an interview, the Human Resource Manager of Nestle´ Ghana Limited commented that the company changed most of their equipment every five

years and sold them as scrap. This was because they were not aware that the polytechnics could use them as teaching and learning materials. Also, as to whether industry provided funds specifically for research in the polytechnics, the results of the study revealed that 20.0 percent of the members of industry agreed, 31.8 percent were undecided, whilst 48.2 percent disagreed with the statement that industry provided funds specifically for research in the polytechnics (Table 4).

The views of members of industry as to whether industry executives were invited to polytechnics as guest lessons or lecturers regularly, responses showed that 38.8 percent of the members agreed with the statement. However, 24.7 percent and 36.5 percent of the members of industry were undecided and disagreed respectively to the assertion that industry executives were invited to polytechnics to deliver lectures regularly (Table 4). In an interview, the manager of Bonzali Rural Bank in Tamale remarked that there was minimal collaboration between the polytechnic and industry. This was because the polytechnic just dumped students on the bank for attachment without informing them about the type and depth of training needed for the students on attachment.

The last issue used in ascertaining the linkage between polytechnics and industry was on the involvement of industry in drafting and reviewing the curricula of polytechnics. In this regard, it was observed that while 20.0 percent of the respondents were in agreement, 28.2 percent were undecided on the involvement of industry in drafting and review of curriculum for polytechnics. However, 51.8 percent of the respondents disagreed with the assertion that industry was involved in drafting and reviewing of curricula of polytechnics. In this regard, the Managing Director of Japan Motors in Takoradi stated, in an interview, that besides students coming on industrial visits or lecturers coming to supervise students on practical attachment, he did not know of any other linkage that existed between their company and the polytechnics.

Fundamentally, the perceptions of senior members, students, members of industry and professional associations seem to suggest an existing collaboration between polytechnics and industry in the development of human capital in Ghanaian polytechnics. The views of the stakeholders would remain a perception without ascertaining the extent of collaboration and the differences in the views of stakeholders in relation to the polytechnic-industry linkage in human capital development.

In this regard, a one-way between groups ANOVA with post-hoc tests was employed to ascertain the differences in the polytechnic-industry linkage across the four stakeholders in developing the human capital of students. The output of the analysis showed the descriptive statistics, ANOVA, and multiple comparisons of the mean difference. The descriptive statistics of stakeholders for polytechnic-industry linkage in terms of the number in each group, means, standard deviation, and standard error as well as the confidence interval for mean, minimum and maximum is presented in Table 5.

The overall mean score (M=25.18, SD=6.47) and category of stakeholders' mean score (students [M=24.26, SD=6.09]; senior members [M=24.68, SD=6.13]; industry [M=29.96; SD=6.64] and professional associations [M=24.58, SD=6.11]) represent the average difference of the stakeholders in the polytechnic-industry collaboration at 95percent confidence interval.

Table 5: Descriptive statistics of stakeholders for polytechnic-industry linkage

				95% confidence interval for mean			
Respondents	N	M	SD	Lower bound	Upper bound	Minimum	Maximum
Students	355	24.26	6.093	0.323	23.62	8	24.90
Senior members	118	24.68	6.132	0.565	23.56	11	25.80
Industry	85	29.96	6.647	0.721	28.53	11	31.40
Professional association	36	24.58	6.110	1.018	22.52	10	26.65
Total	594	25.18	6.473	0.266	24.66	8	25.70

N=Number M=Mean SD=Standard deviation
Source: Field survey, 2012

However, the mean score does not provide the statistically significant difference on the polytechnic-industry linkage for the stakeholders. Hence, the need for ANOVA, which gives both between-groups and within-groups sums of squares, degrees of freedom (df), mean squares, F-value and sig. (ρ-value). The results of the ANOVA indicated that there was a statistically significant difference at the ρ<.05 level in the polytechnic-industry linkage scores for the four stakeholders (students, senior members, industry and professional associations), that is, [F (3, 590) =19.95, ρ=.000]. This means that there is a significant difference somewhere among the mean scores on the dependent variable (overall polytechnic-industry linkages) for the four groups (students, senior members, personnel of industry, and professional associations). Table 6 illustrates the ANOVA for the total polytechnic-industry linkages.

Table 6: ANOVA for total current polytechnic-industry linkages across the four stakeholders

Source	Sum of squares	Df	Mean square	F	Sig.
Between groups	2289.520	3	763.173	19.959	.000
Within groups	22559.565	590	38.237		
Total	24849.084	593			

Source: Field survey, 2012

Having observed a statistically significant difference in the means scores on polytechnic-industry linkages across the four stakeholders in Ghanaian polytechnics, the hypothesis which states that, there is no significant difference in terms of the current polytechnic-industry linkages across the four stakeholders (senior members, students, industry and professional associations) in Ghanaian polytechnics, is not accepted. It can be concluded that there are disparities in the perceptions of stakeholders on polytechnic-industry linkages in Ghanaian polytechnics.

However, this does not clearly indicate the differences in perception of one stakeholder from the other on the polytechnic-industry linkage in Ghanaian polytechnics. For example, it does not explicitly show how perceptions of students differ from senior members or members of industry or professional associations, and vice versa. In this regard, there is the need for a multiple comparison of the mean scores by employing the post-hoc test to ascertain the statistical significance of the differences between each pair of groups.

The post-hoc multiple comparison, using Tukey HSD test, indicates the pair of groups (stakeholders), mean differences, standard error, sig. and 95percent confidence level interval. Consequently, the statistically significant difference observed in the overall ANOVA provided the need to use the post-hoc test to locate exactly where the differences occur between the pair of respondents. The results of the post-hoc test are presented in Table 7.

The results of the post-hoc comparisons, using the Tukey HSD test, indicated that perception of students and industry; senior members and industry, as well as industry and professional associations on polytechnic-industry linkages in human capital development was statistically significantly different from one another, and vice versa. Similarly, the mean scores for students (M=24.26, SD=6.09) and industry (M=29.96, SD=6.64); senior members (M=24.68, SD=6.13) and industry (M=29.96; SD=6.64) and between industry (M=29.96, SD=6.64) and professional associations (M=24.58, SD=6.11) were significantly different from one another at the 95 confidence interval.

Despite reaching statistical significance, the actual difference or the effect size (.09) in the mean scores of the respondents was moderate. The effect size was determined by the criterion classification which states .01 as small effect, .06 as moderate effect and .14 as a large effect (Cohen, 1988). The effect size using eta squared is defined by dividing the sum of squares between-groups (2289.520) by total sum of squares (24849.084). However, the difference between students and senior members, students and professional associations, senior members and professional associations was not significant.

Table 7: Dependent variable: Total polytechnic-industry linkages across the four stakeholders

Tukey HSD

(I) Respondents	(J) Respondents	Mean difference (I-J)	Std error	Sig.	95% confidence interval Lower bound	Upper bound
Students	Senior members	-.419	.657	.920	-2.11	1.27
	Industry	-5.706*	.747	.000	-7.63	-3.78
	Professional associations	-.324	1.082	.991	-3.11	2.46
Senior members	Students	.419	.657	.920	-1.27	2.11
	Industry	-5.287*	.880	.000	-7.55	-3.02
	Professional associations	.095	1.177	1.000	-2.94	3.13
Industry	Students	5.706*	.747	.000	3.78	7.63
	Senior members	5.287*	.880	.000	3.02	7.55
	Professional associations	5.381*	1.230	.000	2.21	8.55
Professional Associations	Students	.324	1.082	.991	-2.46	3.11
	Senior members	-.095	1.177	1.000	-3.13	2.94
	Industry	-5.381*	1.230	.000	-8.55	-2.21

*The mean difference is significant at the .05 level

Source: Field survey, 2012

Similarly, the one-way between groups ANOVA with post-hoc tests was employed to ascertain the differences in the polytechnic-industry linkages across the four polytechnics (Accra, Kumasi, Tamale, and Takoradi) in Ghana. The output of the analysis on the descriptive statistics of the polytechnics for polytechnic-industry linkages showed an overall mean score (M=25.18, SD=6.47) and category of polytechnics' mean score (Accra [M=26.66, SD=5.85]; Kumasi [M=24.91, SD=6.28]; Tamale [M=22.95; SD=7.21] and Takoradi [M=25.77, SD=6.25]) represent the numerical average difference of the polytechnics in the polytechnic-industry collaboration at 95percent confidence interval and not a consensus rating by the polytechnics (Table 8).

Table 8: Descriptive statistics of polytechnics for polytechnic-industry linkages

Respondents	N	M	SD	95% confidence interval for mean		Minimum	Maximum
				Lower bound	Upper bound		
Accra	128	26.66	5.848	.517	25.63	14	27.68
Kumasi	169	24.91	6.276	.483	23.96	11	25.86
Tamale	113	22.95	7.207	.678	21.60	8	24.29
Takoradi	184	25.77	6.252	.461	24.86	10	26.68
Total	594	25.18	6.473	.266	24.66	8	25.70

Source: Field survey, 2012

Nevertheless, the mean score does not provide the statistically significant difference on the polytechnic-industry linkage for the polytechnics. Hence, the need for a test of significant difference using ANOVA. The results of the ANOVA showed that there was a statistically significant difference at the $\rho<.05$ level in the polytechnic-industry linkage scores for the four polytechnics, that is, [F (3, 590) =7.54, $\rho=.000$]. This implies that there is a significant difference somewhere among the mean scores on the dependent variable (overall polytechnic-industry linkages) for the four polytechnics (Table 9).

Table 9: ANOVA for total polytechnic-industry linkages across the four polytechnics

Source	Sum of squares	df	Mean square	F	Sig.
Between groups	917.908	3	305.969	7.543	.000
Within groups	23931.176	590	40.561		
Total	24849.084	593			

Source: Field survey, 2012

The resulting statistically significant difference in the mean scores on polytechnic-industry linkages across the four polytechnics in Ghanaian polytechnics shows that the hypothesis which states that there is no significant difference in terms of current polytechnic-industry linkages across the four selected polytechnics (Accra, Kumasi, Tamale and Takoradi) in Ghana, is not accepted. It can be concluded that there are disparities in the perceptions of the polytechnics on polytechnic-industry linkages in Ghanaian Polytechnics. However, this does not clearly spell out the differences in perception of one polytechnic from the other on the polytechnic-industry linkage. In this regard, the post-hoc multiple comparison, using Tukey HSD test, was employed to ascertain the statistical significance of the differences between each pair of polytechnics (Table 10).

The results of the post-hoc comparisons, using the Tukey HSD, indicated that the perception of Accra and Tamale; as well as Tamale and Takoradi on polytechnic-industry linkages was statistically significantly different from one another, and vice versa, in Ghanaian Polytechnics. Similarly, the mean scores for Accra (M=26.66, SD=5.85) and Tamale (M=22.95; SD=7.21); Tamale (M=22.95; SD=7.21) and Takoradi (M=25.77, SD=6.25) were significantly different from one another. In spite of reaching statistical significance, the actual difference (.04) in the mean scores of the respondents was small. The effect size was determined by the criterion classification which states .01 as small effect, .06 as moderate effect and .14 as a large effect (Cohen, 1988). The effect size, using eta squared, is defined by dividing the sum of squares between-groups (917.908) by total sum of squares (24849.084). However, the difference between Accra and Kumasi, Accra and Takoradi, Kumasi and Tamale, Kumasi and Takoradi was not significant.

Table 10: Dependent variable: Total polytechnic-industry linkages across the four polytechnics
Tukey HSD

(I) Respondents	(J) Respondents	Mean difference (I-J)	Std error	Sig.	95% confidence Interval Lower bound	Upper bound
Accra	Kumasi	1.745	.746	.091	-.18	3.67
	Tamale	3.709*	.822	.000	1.59	5.83
	Takoradi	.890	.733	.618	-1.00	2.78
Kumasi	Accra	-1.745	.746	.091	-3.67	.18
	Tamale	1.964	.774	.055	-.03	3.96
	Takoradi	-.855	.679	.589	-2.60	.89
Tamale	Accra	-3.709*	.822	.000	-5.83	-1.59
	Kumasi	-1.964	.774	.055	-3.96	.03
	Takoradi	-2.819*	.761	.001	-4.78	-.86
Takoradi	Accra	-.890	.733	.618	-2.78	1.00
	Kumasi	.855	.679	.589	-.89	2.60
	Tamale	2.819*	.761	.001	.86	4.78

*The mean difference is significant at the .05 level.
Source: Field survey, 2012

Even though the conceptual framework indicates that there is a link between the polytechnics and industry in the development of the human capital potentials of students in Ghanaian polytechnics, the findings of the study on polytechnic-industry linkage indicated that the linkage was weak. This finding is consistent with those of Akomaning (2007) and Mensah (2008) who also found that the relationship between Ghanaian Polytechnics and industry was rather weak.

A critical observation of the findings of this study reveals that the situation is not encouraging enough in the light of polytechnic-industry relationship. This is attributed to the attitude of most polytechnic administrators towards practical industrial training programmes. Most polytechnics contacted were simply very concerned with the theoretical aspects of the curriculum and placed very little or no premium on the practical training programme, which underpins the polytechnic curriculum. In this regard results of the study confirmed that only Takoradi Polytechnic assigned a total of four credit hours to industrial attachment for all HND programmes. For instance in an interview, the Head of the Industrial Liaison Office of the Takoradi Polytechnic confirmed:

> Industrial attachment in Takoradi Polytechnic is a compulsory 4-credit hour programme for HND first and second year students; 17 credit hours for CBT Civil Engineering students, and 15 credit hours for Bachelor of Technology students.

In Kumasi polytechnic, only Civil Engineering, Dispensing Technology, Estate Management and Fashion Design and Technology programmes attract credit hours for industrial attachment, all others do not. In Accra polytechnic, only the CBT Fashion Design and Technology programme attracts credits for the practical training components. In fact, some polytechnics just considered industrial attachment as a non-scoring programme. For that reason, even though most students enthusiastically undertake industrial attachment on their own, it was not mandatory for students in such institutions, especially Tamale and Accra Polytechnics, since it attracted no credit hours. This contributed to the current basis for the poor relationship between polytechnics and industry. However, steps are being taken in the polytechnics to place emphasis on the significance of polytechnic-industry linkage based on competency based training and industrial attachment in the development of human capital potentials of students for the world of work.

The results of the study established that the only form of linkage or interaction with industry was in the area of placement of students for industrial attachment and occasional visits by some polytechnic students to selected industries. However, it was further established that with the introduction of the Competency Based Training (CBT) approach, where practical training forms a major component of the curriculum, the establishment of a strong polytechnic-industry relationship was inevitable in terms of training, curriculum development and reviews.

6.0 Conclusions and recommendations

The framework of activities and mandate of the polytechnics to run career-centred, technically related and more practically oriented programmes is implicitly and explicitly encapsulated in the Polytechnic Law, PNDCL 321 as repealed by the Polytechnic Act of 2007, and Act 754. Significantly, the programmes of the polytechnics are approved by regulatory bodies such as the National Accreditation Board (NAB), National Council for Tertiary Education (NCTE), National Board for Professional and Technician Examinations (NABPTEX), and Council for

Technical and Vocational Education and Training (COTVET). The educational strategic plan for tertiary education (2010-2020) reiterates and emphasis the need to strengthen links between tertiary education and industry in order to promote and review academic programmes and research relevant to national development. This is to be carried out in collaboration with the private sector particularly industry in order to identify pertinent areas for research and development. Also, Ghana's Industrial Policy (GIP) seeks to expand productive employment, technological capacity in the manufacturing sector and promote agro-based industrial development. Considerably, Ghana has had laws, policies and strategies on tertiary education in promoting the development of productive knowledge and technically skilled human capital for industries and national development. However, the production of adequately trained and knowledgeable middle-level human capital for industries cannot be fully achieved without collaboration with supporting institutions and stakeholders of polytechnic education through polytechnic-industry linkages. The existing polytechnic-industry linkage in the development of human capital potentials of students in Ghanaian polytechnics as shown in the conceptual framework is weak. The collaboration was limited to sharpening of lecturer's skills, practical training for students and the drafting and review of polytechnic curriculum. The relatively weak linkage between polytechnics and industry were obvious in joint research, provision of teaching and learning materials, funds for research, as well as in the use of members of industry executives in the polytechnics as guest lecturers and instructors.

The Conference of Rectors Polytechnics (CORP) should take initial steps to meet with the Chief Executive Officers of industries in Ghana and the Association of Ghana Industries (AGI), to initiate the establishment of sustainable collaborative structures that will enhance polytechnic-industry linkages in the development of human capital in Ghanaian polytechnics. The structures should include the signing of a memorandum of understanding (MOU) on joint research and development, joint research publications, establishment of practical training funds, and the organisation of practical training seminars, workshops and conferences. There should also be collaborations in the review, update and development of curriculum, regular use of members of industry executives as guest or part-time lecturers and instructors as well as the provision of teaching and learning materials. A fund should be established for the purposes of industrial attachment, research and publication. The polytechnic-industry collaboration should be premised on results of needs assessment of polytechnics and industries, sector industry trends, and innovation and industrial manpower development.

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