Practice-Theory Integration in Engineering Content Implementation Endeavors: The Cases of Three Public Universities of Ethiopia

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Abstract: This study intended to examine the engagement of university engineering teachers in their practice theory integrative content deliveries. Exploring the variations of engineering teachers' practice theory integrative content implementation endeavors as a function of their university teaching experiences and university generation type was another purpose of this study. By using a questionnaire, the study collected data from 310 engineering teachers selected by stratified random sampling. Academic officers, engineering students, and teachers selected purposively participated in the interview sessions. One sample t-test, ANOVA, Post Hoc test, Pearson correlation coefficient and multiple regressions were employed as quantitative data analysis techniques. Finally, the findings of the study revealed that unlike their practical and practice-theory integrative content implementation involvements, engineering teachers' theoretical content implementation practice was in a better status. High and medium experienced teachers did better practice-theory integrative content implementations than low experienced teachers did. Likewise, teachers from First Generation University did best in implementing practice-theory integrative contents in comparison to second and third-generation universities which were on the same level. Both practical and theoretical content implementation practices of engineering teachers contributed 43.94% towards their practice-theory integrative content implementation endeavors in such a way that the former contributed 35.02% and the latter 8.92%. It was concluded that experience was a significant factor for realizing acceptable practice-theory integrative content implementations. It was also recommended that engineering academic institutions and their teachers need to emphasize the practice-focused teaching-learning experience by exposing their students to the practical scenario through industry visits, reflective reports and presentations for ensuring better practice-theory integrative content implementations.

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Background

In the earlier times learning was mainly dependent on one's own day-to-day practical engagements and interactions with the social/physical environments mainly for the sake of survival (Mann, 1998). From their practical engagements, people started to formulate certain theoretical frames which might be important to handle similar problems in the future (Love, 2012) although there was no proper archive. Nonetheless, through time information, facts and principles were accumulated and transmitted in the form of oral literature, print media and recently in electronic media (UK Universities Association, 2015; Kahsay, 2012). From these stocks of information, learners might get their own theoretical understanding through arbitrary listening, reading and/or formal schooling. As a consequence, the transferring of this information from the stock to the learner became a major preoccupation of schooling (Kleef,2007) although it was later asserted that it had little contribution to learners' active and interactive learning (Freire, 1970). As per the transfer of knowledge, the teacher was considered as the main agent of knowledge delivery for a long period of time until the ideas of constructivists (Dewey, 1974; Vygotsky, 1978; Kolb, 1984) started to challenge it (Reason & Kimball, 2012). Therefore, at that time, learning at the formal educational institutions with formal curriculum was influenced by the treatments and understandings of theoretical contents via theory-led instruction.

However, through time, practice-led instruction is now popular because educational practices, particularly at the university level, could be taken as the major turning point in order to prepare learners for different occupational levels. In other words, fully professionalism in certain occupation needs to have not only theoretical understandings but also practical engagements (Abebe, 2014; Wrenn & Wrenn, 2009; Dewey, 1974) indeed with their integration in such a way that one enhances the other (Leinhardt et al, 1995). The teaching-learning processes in the university, therefore, have to ensure the right and real integrative practices between theory and practice of the curricula under treatment (Gao & Rhinehart, 2014; Abebe, 2014; Ayenachew, 2012).This makes the higher education institution is an ideal institution (Harste et al, 2002; Baddely, 1998) where its learners get comprehensive knowledge, skills and affection to join the world of work with confidence. It seems acceptable that the university has to cheek whether its graduates are well equipped to theorize and practice their university learning thereby to interpret and apply it in their workplace at ease. In support of this, recently, there are various curricular packages (e.g. apprenticeship in engineering, practicum in education, etc.) that are mainly assigned for realizing university-industry linkage thereby ensuring university students' practice-theory integrative learning engagements (Teshome, 2007;MoE, 2009; Ernst & Young, 2010; Association of Universities and Colleges of Canada, 2011).

Other writers like Neville and Adam (2003)and Kleef (2007) also contend that learning becomes complete if it addresses both the theory and practice version of the course in an integrative manner so that one (e.g. the practice) can serve for the better learning of the other (e.g. the theory). As a matter of these facts, Ethiopian universities in general and engineering academic units, in particular, have proposed (at least in their curricular and policy documents)that their course implementations need to be in a form of practice-theory integrations (Ministry for Economic Cooperation and development, 2007; MoE, 2012)though the reality at the ground is not yet confirmed (Hewan, 2015; Zenawi, 2012) through systematic and comprehensive investigations. This study is aimed at filling this gap.

Based on this assumption, this study examines the status of university engineering teachers' involvement in the theoretical and practical content implementation and investigates its effect on practice-theory integrative content deliveries. Engineering can be considered as an applied science of natural sciences especially physics, chemistry, and mathematics (Mann, 1998; Jamieson, 2007). Engineering, as a field of study, focuses on systematizing and synchronizing the physical environments so as to utilize them in different forms and for different purposes (Boeing, 1997; Smith, 2012). Courses in engineering, therefore, include designing, building, molding, shaping, etc. of the physical entities for having various equipment including very sophisticated items (e.g. airplane, computers and other satellite instruments) (Smith, 2012). To manufacture such items, although theoretical principles, procedures and formula are important, practice-focused engagements (in fact with reasonable practice-theory integration) should take the lion's share of the manufacturing processes (Sheppard & Sullivan, 2007). Therefore, this study can be considered as timely and valuable in order to show possible interventions that may emerge from the data.

Practice-theory integrative activities as per respondents' university generation type (first, second and third-generation) and teaching experiences (high, middle and low) are also the other concern of this study. Experiences of institutions/universities in offering a variety of training and course deliveries play a significant role. This is true because availabilities of experienced human resources, infrastructure and materials (Neill, Singh and Donoghue, 2004; Ernst and Young, 2010), which are useful for better course implementation; go hand in hand with the seniority level of the institution. Ernst and Young (2010), for example, stated that the maturation level of the staff is highly associated with the work experience or seniority of the university. This can be taken as an advantage for practicing and then realizing different packages of the education system (e.g. practice-theory integrative content implementation). Nevertheless, those teachers who have high rank and experience from high experienced (e.g. first generation) universities might be resistant or supportive depending on the level of their involvement (Haddawy&Igel, 2006) while the change package is framing, introducing and processing. One of the important packages of Ethiopian education system, practice-focused integrative content implementation (MoE, 2009; MoE, 2010; Ayenachew, 2012), therefore, can be affected (positively or negatively) by university generation type which is usually defined and classified based on the level of its experiences.

Years of teaching experience can be taken as one of the basic factors that influence teachers' teaching effectiveness in general (Mueller, 2012) and their practice-theory integrative content implementation, which is relatively demanding, in particular. However, these days, the contributions of years of teaching experience on teachers' teaching effectiveness are becoming controversial issues. For instance, Johnston (2014) concluded that the value of teaching experience in teachers' teaching and assessment activities seems to be accepted without any doubts. On the contrary, Duke (1990) and Mueller (2012) summarized that years of teaching experience by itself is not a guarantee for effective teaching including practice-theory integrative content implementation unless it is activated with different motivational factors. Nonetheless, the experience ultimately determines teachers' actions. From these discussions, one can learn that, eventually, both the experiences of institutions and teachers have their own contributions although it can be determined from their level of understanding about the purpose and value of the teaching-learning package introduced and promoted. Therefore, investigating practice-theory integrative content implementation status with reference to university generation type and teachers' university teaching experiences seem valuable. Purposively selected institutions: Bahir Dar (as first-generation), Wolega (as second generation) and Wolikitie (as third-generation) Universities are located in the three populated regions of the nation so that they can be ideal to suggest sort of representative suggestions about the issue under investigation.

Practice-theory integrative content implementation naturally emerged from the theory of constructive learning as it is indicated and promoted by Dewey (1974), Vygotsky (1978), Kolb (1984) and Schon (1987). Therefore, in engineering course syllabi the practical experiences/contents better to adjust as the mirror image of each of the theoretical contents via the discussions of varied practical experiences into the classroom (Jamieson, 2007), practical works in the workshop (Koen, 2003) and real industry visits (David, 2015). In this case, students can construct an integrative and comprehensive picture between their theory and practice learning rather than learning them independently into pieces (Abdulla, 2011).Theoretical contents can be defined as formal knowledge in most cases developed through reliable and valid research processes and results (Thompson, 2000; Baddely, 1998). It can also accommodate practical action involvements when the actions are successfully working in various scenarios but with similar instances (Schon, 1987; Higgs, 2011). Therefore, theoreticians can understand the theory of something from reading, classroom learning, conference participations etc. Practitioners may learn and develop some theoretical concepts (frames) from their practical engagements (Schon, 1987; Reason & Kimball, 2012) while they exercise certain actions frequently. In this regard, Love (2012) noted that theory and its content learning are highly related to individuals' thinking engagement so as to systematize observations and their future actions (Kleef, 2007*)* through utilizing previous theoretical concepts, formula, rules, procedures, etc. as a guideline.

Practice refers to the processes of doing something by using the already formulated theoretical rules and procedures and/or the patterns obtained from the engagements of earlier practical actions (Leinhardt et al, 1995; Good & Schubert, 2001). Even sometimes practical content learning might be started from zero formula through trial and error (Schon, 1987; Yorke, 2005) while someone is engaged to solve problems. In any cases practical content learning accomplishes mainly through physical movements and involvements of course together with mental thought investments (Yorke, 2005). Such learning might be realized by exposing students to the real and practical experiences, to the model/simulation experiences, to the workshop/laboratory experiences as well as to the practical examples mentioned in the theoretical classroom. However, teachers, students (Koen, 2003; Jamieson, 2007) and the experts in the industry sectors (Abdulla, 2011, Haddway&Igel, 2006) are with lack of proper awareness about the criticality of practical content implementation. Therefore, their practice-theory integration seems weak; rather they focus on either of the two, especially the theoretical content (Sheppard and Sullivan, 2007) which is relatively comfortable to deal with (Felder & Brent, 2003; Daughtrey&Wiedor, 2010).As a result, practice-theory integration content delivery remains untouched (Love, 2012).

Engineering education needs to treat both the theoretical and practical contents in a fair, logical and integrative manner(Duderstands, 2008), since missing either of the two (particularly missing the practical side of a lesson, (Ramanathan &Ramanath, 2009)makes university graduates incomplete, incompetent and less confident in handling their professional occupation in the real setting. As a matter of fact nowadays higher education institutions around the world in general (Haddway and Igel, 2006; Ernst and Young, 2010)and in Ethiopian context in particular (Ministry of Science and Technology, 2015; Ayenachew, 2012;MoE, 2009) entertain a variety of educational amendments and reforms in order to ensure practice-theory integration in engineering courses. For example, the system of Ethiopian higher education requires a number of industry-field visits while engineering courses are being delivered and one-semester students' apprenticeship engagement (Hellen, 2015).

Nevertheless, in Ethiopia, the two entities of the course (theory and practice) are arranged at different seasons(Ministry of Science and Technology; 2015)although they are naturally arranged within a continuum (Grham, 2018; Neville &Adam, 2003). This might be helpful for teachers and students to deliver courses by moving from one end (e.g. theory) to the other (e.g. practice) even within seconds, minutes, hours, weeks, etc.of their learning teaching endeavors. But engineering students in Ethiopia learn theoretical topics 2-3 years with minimal exposition (if any) to the industrial environment real practices and then they are assigned for one semester fully industry apprenticeship (Ministry of Finance and Economic Cooperation, 2010).After that students go back for classroom theoretical discussions although the recent literature in engineering education (Geo &Rhinehart, 2014; Love, 2012; Wrenn & Wrenn, 2009)gives more emphasis to the treatment of practice-theory simultaneously rather than working them one by one. Therefore, unlike treating them separately,in practice-theory integrative content implementation,the learning of one (e.g. theory) enriches the other (e.g. practice) (Brockett &Hiemstra, 1985) for the reasons that both are naturally interrelated and interconnected.

Although practice-theory integration content delivery is advisable (Dewey, 1974; Schon, 1983) for all disciplines, it is seriously recommended for engineering contents (Duderstands, 2008) because engineering by its nature focuses on hands-on technological training (Mann, 1988) since graduates routinely face a situation to involve in doing with huge projects which might be so expensive and risky(Felder & Brent, 2003).As a matter of fact, engineering teachers and students need to check their work across the line of theory-practice continuum by making forth-back movements in their teaching-learning practices in the university classroom as well as in the industry(Sheppard & Sullivan, 2007).

To realize this for engineering course deliveries, therefore, exercising practice and theory treatments simultaneously seems very important. That is to mean, within a single classroom instruction time (Sheppard & Sullivan, 2007; Ramanathan and Ramanath, 2009)teachers and students need to mention some practical examples/exercises from the industry sector and even plan visits to it (Koen, 2003; Smith et al; 2005) rather than leaving aside the practical content learning for some other years or semesters.The same is true while the practical apprenticeship is going on at the industry (Smith et al; 2005). In other words, teachers and students should work in developing certain theoretical patterns and formula when they engage in the industry for practical apprenticeship. If this is true, theory and practice might be mutually benefitting entities in such a way that one serves as a milestone to learn the other. If not, especially in engineering courses (Boeing, 1997), it seems good to begin the teaching-learning practices from the practical version of the contents and then move to the development of formula and principles (Dewey, 1974; Schon, 1987). This might give priority for better practical content learning than the theoretical ones which is more important in making engineering students capable for securing bread for themselves and then contributing something for their country's development (Higgs, 2011; Jamieson, 2007) than the theoretical contents do. Rather theoretical contents are mainly useful for having sophisticated knowledge as mental wealth(Koen, 2003) although they are useful to guide practical work.

Therefore, in order to ensure complete professionalism among engineering graduates, the university academia has to be convinced with the development of both theory and practice among their students instead of implementing the learning-teaching processes of the two as an independent package with different time schedules. As a consequence, practice-theory integrative content implementation is realized by which learners' professionalism capacity becomes strong (Higgs, 2011). However, it seems automatic to have sessions that work in focus with either of the two contents (e.g. classroom discussion for theoretical and workshop/industry visit for practical contents) (Gao &Rhinehart, 2014). What seems important here is that there should be interactive discussions along the continuum rather than being ignorant for either of the continuum end. Hence, this study is planned to examine whether this intention is realized in engineering academic units by taking selected Ethiopian universities as a setting.

Statement of the Problem

Maximum theoretical content discussion, without proper reflection and demonstration about its correspondence actual practical dimensions, was taken as a serious problem to make university graduates competent in their real and practical professional engagements (Abebe, 2012; Higgs, 2011). In other words, interpreting and transferring the university classroom theoretical knowledge into actual practices or vocations remain untouched (Leinhardt et al, 1995; Harste et al, 2002; Teshome, 2007; MoE, 2012) although this part is critically important as it can be automatically salable in the market for having changes in various segments of development (Wrenn and Wrenn, 2009; Higgs, 2011; MoE, 2012). For this reason, educators (Dewe, 1974; Schon, 1983; Kohlb, 1984) proposed that classroom theory teaching should base and integrate with the related practical experiences so that utilization of theoretical discussions into practical contexts will be acievable (Yorke, 2005). In effect, these days, learning in most parts of the world has given emphasis for practice-based learning approaches (MoE, 2009; Kahsay, 2012; Gao, & Rhinehart, 2014) of course by giving attention for the theoretical content continuum too.

To this end, Ethiopia, like any other parts of the world, has tried to adapt this model of learning by introducing the essence of university industry linkage in higher education institutions (Teshome, 2007; MoE, 2012) which can be taken as basic ingredients to exhaust the practical contents learning and promote integration between theory and practice. However, studies in Ethiopia found that the quality of university graduates in both of their theoretical and practical content handling ability is deteriorating from time to time (Ayalew et al, 2009; Zenawi, 2012) of course with a serious problem to that of the practical version contents (MoE, 2010; 2012; Hellen, 2015; Ministry of Science and Technology, 2015). On top of this, the problem is more critical in engineering field graduates (Teshome, 2007; Graham, 2018) especially in the third world including Ethiopia. For instance, teachers, students, management body and even people from the industry sector mainly see engineering students' practical apparent ship engagement as a sort of arbitrary fulfillments (Neville & Adam, 2003) for their degree though it is the most decisive component of engineering training (Graham, 2018). As a consequence, now-a-days, engineering graduates in Ethiopia may not be assumed as fully professionalism (Hewan, 2015; Ministry of Economic & Cooperation Development, 2010) which mainly attributed for teachers and their teaching practices (Abdulla, 2011).

As a result, studying the status of university engineering teachers' practice-theory integrative content implementation and looking some alternative strategies for intervention seems timely agenda to study. The study also tried to examine the contributions of theoretical and practical content deliveries on practice-theory integrative content implementation. Because personnel and institution experience is among the important factors to determine performance, assessing practice-theory integrative content implementation variations across engineering teachers' teaching experience and university generation type was also another purpose of the study. To this end, the model (see Fig.1) shows the basic variables and their relationships (as they discussed in the background and statement of the problem) in order to guide the research including the frames of the basic questions.

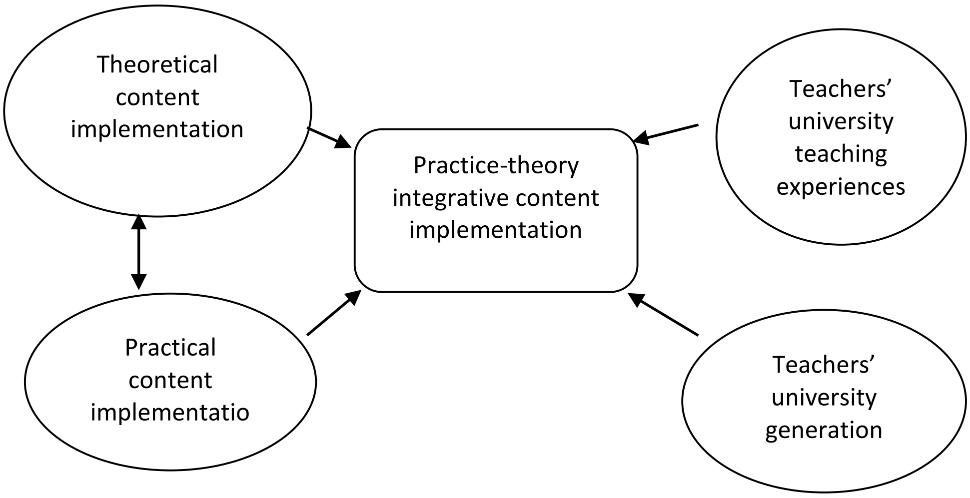

Fig.1: Conceptual Framework of the Study

Based on the introductory discussions and the above conceptual frameworkof the study (Fig.1), the following research issues are framed:

- the status of engineering teachers' practical content, theoretical content and practice-theory integrative content implementation endeavors;
- whether there is any significant difference among engineering teachers' practice-theory integrative content implementation engagements as far as their university teaching experiences and university generation type are considered; if so, which group is significantly different from the others; and
- the independent and multiple contributions of engineering teachers' practical and theoretical content implementation practiceson theirpractice-theory integrative content implementation performances

Operational Definitions

Practical contents implementation: the teaching-learning process that devotes more time and energy on the extreme practical ends of the theory-practice continuum. This variable was measured by 14 five scale items.

*Theoretical contents implementation***:** the teaching-learning process that devotes more time and energy on the extreme theoretical ends of the theory-practice continuum. This variable was measured by 16 five scale items.

Practice-theory integrative content implementation: the teaching-learning process that moves back and forth along the theory-practice continuum so as to treat practical and theoretical contents at a time and in interwoven manner. This variable was measured by 12 five scale items.

*University teaching experience***:**engineering teachers' years of experience in teaching at the university. The teachers, who have below

8 years, 8-15 years and above 15 years teaching services, considered as low, medium and high experienced teachers, respectively.

University generation type: In relation to the age of establishment of the respective universities, in Ethiopia, universities are classified into four generations. However, because they are fully functional, this study examined only the first three generation universities. First generation universities are founded before and in 2000 (e.g. Addis Ababa, Bahir Dar Universities and others), second generation in 2007 (e.g. Wollo,Wolega Universities and others) and third generation in 2011 (e.g. Debre Tabor,Wolikitie Universities and others).

Significance of the Study

This study is useful in informing different stakeholders like engineering students and teachers, university and engineering colleges academic managers, and the industry sector managers and experts as well about the status of theoretical, practical as well as practice-theory integrative content implementation engagements. Then, the stakeholders will understand and act accordingly for bridging the gap of engineering training (if any) thereby have proper professional engineering graduates who are capable of implementing theoretical and practical contents in integrative manner. It also hints the status of practice-theory integrative content implementation processes while the years of experience of teachers and universities are varied. The study also will help as a stepping stone to explore the issues in a more detailed manner by taking the number of variables and dimensions into account.

Methods

*Design:*Data were collected from different geographical area and relatively from large sample size population. Moreover, attempts were taken to examine contemporary status of practice-theory integrations by taking university engineering teachers' questionnaire survey response as a major data. In such contexts, a quantitative descriptive survey is an appropriate design (Creswell & Clark, 2007).Therefore,the author employed a descriptive survey design by taking quantitative data and its analysis result as the major ones and of course this was supported by qualitative data which was collected through interviews.

*Sample Selection:*University undergraduate engineering teachers are the major focus of this study because they are directly responsible for managing curriculum implementation including practice-theory integrative content implementation by encouraging their students towards that. To have further insight into the problem, different levels of academic officers and fifth year undergraduate students in engineering were included. With this intent, of the public universities of Ethiopia, three universities were selected through purposive sampling. Locations of sample universities, for relatively fair representativeness of the country' public universities, experience level of universities and access for the researcher were considered as a criterion for selecting the sample universities of the study. Bahir Dar,Wolega and Wolikitie Universities were selected as representatives of first, second and third generation universities, respectively.

The target population was 528 (468 males and 61 females) engineering teachers that were found in the aforementioned three sample universities. In order to have reasonable sample size from different levels of teaching experiences and university generation type, 321engineering teachers (309 males and 12 females) were selected through stratified random sampling and participated in the study. A questionnaire was distributed for all 321 respondents though 11 of them did not return it. As a result, 310 teachers (298 males and 12 females) properly completed and returned the questionnaire. This makes the rate of return of the questionnaire 96.57% that could be taken as very good for survey studies like this one. With regard to participants' university generation type, 1stgeneration=112,2ndgeneration=104 and 3rdgeneration=94. In line with their years of experience, high experienced=108, medium experienced=105 and low experienced=97.

Interview participants were 12 people (3 academic officers, 3 teachers and 6 students from graduating class) who were selected purposively. Level of experience, level of qualification, willingness to participate and seniority (for students) were some of the criteria considered to determine interview respondents. To maintain respondents' anonymity, the respondents were labeled as officers (O_1, O_2 and O_3), teachers (T_1, T_{2and} T_3) and students (S_1, S_2. . .S_6).

Instruments: Questionnaire and interview were data collection instruments of the study.

Questionnaire: The questionnaire had two major parts. Its first part had 3 completion items, which helped the researcher to collect preliminary data about teachers' sex, years of teaching experience and university generation type. The second part consisted of 42 close-ended items, which helped to get data about engineering teachers' theoretical, practical and practice-theory integrative content implementations. Of these 42 items, 16 were serving for theoretical, 14 for practical and 12 for practice-theory integrative content implementation practices. The items were constructed by the researcher on the bases of theoretical as well as empirical grounds (particularly from Abdulla, 2011; Gao &Rhinehart, 2014; Higgs, 2011;Kleef, 2007) about engineering teachers' theoretical and practical content implementation practices.

After the questionnaire (46 items)was prepared, the researcher gave the questionnaire to three experts in the area (one PhD holder in mechanical engineering and two PhD holders in curriculum and instruction). Based on the comments of these experts, revisions were made and 2 items which agreements could not be reached were discarded. Finally, 44 items were retained. However, after the data was gathered, it was learnt that two further items were problematic and were discarded as well. Finally, 42 items were used to collect data from teachers to seek data about the topics under investigation. The item analysis was computed by using Cronbach alpha. The reliability coefficients were 0.83, 0.78 and 0.80 for theoretical, practical and practice-theory integrative content implementation items, respectively. The response format, for the close-ended items, used was ranged as *never at all, rarely, often, sometimes and always*.

In scoring, a point of 1 was assigned for a “never at all’’ response, 2 for a “rarely’’ response, 3 for “often” response, 4 for “sometimes’’ response and 5 for an “always” response. Since all the subjects were university teachers, the questionnaire was prepared and administered in English without being translated into other local languages.Data were collected in first semester, 2017 academic year. Data were collected with 2 assistants,who have MA in curriculum and instruction, of course by giving clear orientations and directions about the procedures they should follow.

*Interviews:*To enrich the data obtained through questionnaire, semi-structured interviews were conducted with selected university academic officers, teachers and students. The interview guide items were eight.The items were trying to raise basic concerns mentioned in the leading questions. Interviewers were informed that when the respondents were reluctant to respond or shift from the purpose of the study, they have to attempt for persuading and leading interviewees back to the topic in order to be focusedon the relevant information which is pertinent to the topic.

*Data Analysis Techniques***:** Quantitative data analysis was employed for analyzing the close-ended questionnaire responses. Accordingly, one sample t-test was employed to analyze engineering teachers’ current status of theoretical, practical and practice-theory integrative content implementation endeavors. ANOVA was used to see whether there are mean differences in engineering teachers’ practice-theory integration content delivery across their university generation types and years of university teaching experience. To identify the mean scores that significantly differ from one group to another, **post hoc test** was conducted. To examine the multiple and independent contributions of practical and theoretical content implementation processes towards the practice-theory integrative content implementation engagements, multiple regression was applied. The level of significance was set as 0.05.

The qualitative data collected through interview were discussed qualitatively through thematic-deductive approach. That is to mean, unlike the thematic-inductive qualitative data approach, in thematic-deductive approach, the qualitative interview data is adjusted as per the concepts and essence of the pre-established research questions rather than working to develop themes from the data. To do so, studying the data, arranging the data as per the themes emerged from the research questions, examining the nature and relationships of data between the categories and assigning and interpreting the data were some of the basic steps accomplished.

Results

As Table 1 indicated, the current statuses of the variables under investigation, except the theoretical content implementation, mean scores of practical and practice-theory integrative content implementation were below the expected mean of the population (3.00). Consequently, in order to check the level of significances in the variations between the observed and expected mean of the variables, one-sample t-test was employed. The result revealed that the mean values for practical content implementation (2.43) and practice-theory integrative endeavors (2.52) were significantly below the expected mean of the population but mean value for theoretical content implementation(3.86) was significantly greater than the expected level (Table 1). This implies that engineering teachers'curriculum implementation practices were more focusing on the theoretical content deliveries than their practical and practice-theory integrative content implementation actions.

Table 1: Descriptive Statistics and One-Sample t-test Values on Engineering Teachers' Theoretical Content Implementation (TCI), Practical Content Implementation (PCI) and Practice-theory Integrative Content Implementation (PTICI), (N=310 and Expected Mean=3.00)

Variables	Mean	S.D	t-observed	p-value
TCI	3.86	1.08	3.88	0.00
PCI	2.43	1.12	2.23	0.01
PTICI	2.52	1.23	3.19	0.00

P<0.05; t-critical=1.96 and

Teachers, students and officers' interview responses also seemed to support this quantitative finding. For example, S3, S6, T1 and O3 argued that practical learning engagements in engineering education has been challenged by many problems such as students and teachers' less attention towards it, scarcity of practical workshops, unwillingness of industries to entertain students for practical visits/engagements. This highly affects the practical content implementations negatively (T2 & T1) and therefore teachers and students tend to prefer the theoretical classroom discussions (T3, O2 & S4) although it is less effective and applicable without proper practical (S1 and T3) and practice-theory integrative (S4 and S5) content implementations.

Examining the variations of engineering teachers' practice-theory integrative content implementation as a function of their university generation type and teaching experience was another intent of this study. The mean scores presented in Table 2 showed that there are differences in engineering teachers' practice-theory integrative content implementation behavior among first (3.12), second (2.88) and third (2.36) generation universities. The same table, Table 2, also showed that there are differences among the mean scores of high (3.72), medium (3.33) and low (2.84) experienced engineering teachers. To determine the significance level of variations of these mean scores, one-way ANOVA was employed (Table 3).

Table 2: Mean and Standard Deviation Values for Engineering Teachers' Practice-theory Integrative Content Implementation across the Selected Variables

Selected Variables		N	Mean	S.D
University	First	112	3.12	1.18
Generation	Second	104	2.88	1.80
Type	Third	94	2.36	1.27
University	High	108	3.72	1.06
Teaching	Medium	105	3.33	1.04
Experience	Low	97	2.84	1.73

The ANOVA results portrayed that there were statistically significant mean differences among Bahir Dar, Wolega and Wolkitie University teachers as representatives of first, second and third generation university teachers (Table 3), respectively. The same table, Table 3, also indicated that mean variations were statistically significant among high, medium and low experienced engineering teachers.

Table 3:One Way ANOVA Summary Table for Engineering Teachers' Practice-theory Integrative Content Implementation as the Function of Their University Generation Type and Teaching Experience (N=310 and Expected Mean=3.00)

Sources of Variation		Sum of squares	df	Mean Square	F	P- value
University Generation Type	Between Groups	378.24	2	384.24		
	Within Groups	498.12	307	2.86		
	Total	876.36	309		121.23	0.01
University Teaching Experience	Between Groups	353.86	2	376.88		
	Within Groups	523.34	307	12.12		0.00
	Total	877.20	309		148.19	

$P<0.05$

In order to identify which generation type (Table 4) and experience level (Table 5) of engineering teachers were relatively better in implementing practice-theory integrative content delivery, post HoC test was utilized. The result indicated that engineering teachers from Bahir Dar University (First Generation University) were relatively better than Wolega (Second Generation University) and Wolkitie (Third Generation University) universities for practice-theory integrative content deliveries (Table 4). On the other hand, there were no statistically significant differences between Wolega and Wolkitie Universities engineering teachers in implementing practice-theory integrative contents. They were in the same zone of implementing practice-theory integrative contents (Table 4). Teachers, students and officers from second and third generation universities, as interview respondents, were complaining about the absences of proper engineering workshops, equipment and professionals to exercise the practical versions of engineering contents (T2, S1, S3 & O2) which is not as such a serious challenge in the first generation universities. For instance, T1 said “These days what I have learnt is that Ministry of Education assigns engineering students even for a university that did not finish classroom constructions and teachers employment properly” (27/11/2017).Such problems make engineering education theory-intensive particularly in less experienced universities (O1, S5, T1 & T2). In support of this, S6 said “our teachers are so careless in working with the practice-focused content implementations. I and most of my friends were not checked (even one time) by our university supervisors while we were staying for a semester apprenticeship in the industry”(12/11/2017).

Table 4: Post HoCTest Mean Comparison Values for Engineering Teachers Practice-theory Integrative Content Implementation as the Function of Their University Generation Type

Group	Denominator	Q-calculated
1st generation Vs 2nd generation	0.98	4.68*
1st generation Vs 3nd generation	0.96	6.31*
2nd generation Vs 3rd generation	1.05	2.42

Q- Critical = 3.31 for r= 3 and df= 307

The Post HoC test in Table 5 depicted that high and medium experienced engineering teachers are relatively greater than the low experienced teachers in their practice-theory integrative content implementation. On the contrary, there were no statistically significant differences between high and medium experienced university engineering teachers in their involvement towards practice-theory integrative contents (Table 5). In support of this, T3, S1 & S2 stated that, let alone they give further assignments and field works for better practical content teaching-learning engagements, fresh teachers even lack to manage their theoretical classroom teaching-learning. “Senior teachers, on the other hand, seemed to have better confidence to assign students in different practical observations thereby to invite them for presentation/demonstration in a way to initiate multidirectional dialogue along the horizon of theory and practice” (T3) (16/11/2017).

This study also planned to see the relationship of the variables of the study thereby to identify the independent and multiple contributions of the predictor variables (practical content implementation, PCI and theoretical content implementation, TCI) over the dependent variable (Practice-theory Integrative Content Implementation, PTCI).

Table 5: Post HoC Mean Comparison Values for Engineering Teachers Practice-theory Integrative Content Implementation as the Function of Their University Teaching Experiences

Group	Denominator	Q-calculated
High VS Middle experienced	0.88	2.88
High VS Low experienced	0.95	5.33*
Middle VS Low experienced	1.05	4.12*

Q- Critical = 3.31 for r= 3 and df= 307

Accordingly, correlation coefficient and multiple regression statistics have reported in Table 6 and 7, respectively. Table 6 revealed that the correlation coefficients between all the variables of the study was positive and in its medium level though the correlation between practical and practice-theory integrative content implementation (0.83) was strong.

Table 6: Interrelationship among Engineering Teachers' Theoretical Content Implementation (TCI), Practical Content Implementation (PCI) and Practice-theory Integrative Content Implementation (PTICI)

Variables	PCI	TCI	PCI
PCI	-		
TCI	0.48	-	
PTICI	0.83	0.43	-

As the regression analysis revealed (Table 7), the multiple contributions of the two predictor variables (PCI and TCI) over the main variable (PTICI) were 43.94%. This informs that 56.06% of the variance for engineering teachers' practice-theory integrative content implementation could be attributed for the other factors which were not yet included in this study. The regression analysis results also indicated that there was significant amount of contributions of engineering teachers' practical content implementation endeavors (35.02%) towards practice-theory integrative content implementation but the contributions of theoretical content implementation (8.92%) was minimal. That is to mean, intensive deal with the theoretical content implementation did not be facilitative for the well accomplishment of the practice-theory integrative content implementation.In general, from the composite contribution of the two predictive variables to the variance of engineering teachers' practice-theory integrative content implementation (43.94%), 79.70% was responsible for engineering teachers' practical content implementations and 20.30% for their engagement about theoretical content implementations.

The direct effects of these two predictor variables on engineering teachers' practice-theory integrative content implementation as $\beta=0.2123$, $t= 3.4416$, $P=0.01$ for theoretical content implementation and $\beta=0.4219$, $t=4.1827$, $P<0.00$ for practical content implementation.

This implies that engineering teachers' practical content implementation involvements were relatively doing better in actualizing practice-theory integrative content implementation than their theoretical content implementation did.

According to the interview data, engineering teachers and students' unfair treatments towards practical and theoretical contents make it difficult to realize practice-theory integrative content implementation (T2 and T3) since integration expects to have right composition between the two (S5, S6 and O3).

Table 7: Results of Multiple Regression Statics of Predictor Variables on the Main Variable: Engineering Teachers' Practice-theory Integrative Content Implementation

Predictor Variables	Regression Coefficient	t- Statistics	P Value
Theoretical content implementation	0.2123	3.4416	0.01
practical content implementation	0.4219	4.1827	0.000
Over all R^2	0.4394		
F value	32.1224		

*P<0.05

Though this is the reality, due to lack of teachers' capacity, non-supportive attitude of people at the industry and scarcity of resources, practical content implementation in engineering education lags behind (T1, T2, S2 and S6) from the theoretical ones. This, as it is also reported in one sample t-test result (Table 1) and in regression statics (Table 7), naturally affects the integration practices negatively (T3, S4 and O2).

Discussions

University engineering teachers seemed to be in a better position of implementing theoretical contents than practical and practice-theory integrative content implementations (Table 1).This might be the reason that engineering graduates are extremely theory-oriented (Ramanathan &Ramanath, 2009; Smith, 2012) but less competent in their practical engagements at the industry. This seems to be an acceptable truth because university engineering teachers are more familiar to the theoretical contents (Wrenn & Wrenn, 2009; Shepard & Sullivan, 2007) during their training at the university and the experiences that obtained from senior teachers encouraged them to be more of theory-focused (Smith et al, 2005). Therefore, it is not that much surprising to see engineering teachers as more of theoretical content implementers than they did for practical and practice-theory integrative contents. This is because working within the zone of familiar tasks is less demanding to prepare and deliver (Kolb, 1984; Vygotesky, 1978). This showed that theory-focused teaching learning (David, 2015) might be taken as a kind of vicious circle problems (Love, 2012) since people are more interested to do things with the approaches that they know very well. That is why the present article found ‘relatively better engineering teachers’ theoretical content implementation’.

When the experiences of universities and teachers are considered, engineering teachers’ practice-theory integrative content implementation involvement was significantly varied as per their teaching experiences and university generation types (Table 3). This might be realistic since practical exposure of experts (Koen, 2003; Mueller, 2012) and accumulative institutional values and conceptions (Ernst & Young, 2010; Haddway&Igel, 2006) that might be developed through experience have their own vital role on the practical teaching-learning engagements. The post Hoc test (Table 4) indicated that teachers in the First-Generation University were the best one in implementing practice-theory integrative content implementation but there was no significant difference between the second and third generation university engineering teachers.

This might be true because the gap in years of experiences between the first generation and the other two (second and third) generation universities are extremely wider (25 years and above) than the experience differences (around 4 years) between the second and third generation universities have. Since practice-theory integrative content implementation involvements of engineering teachers seem to be in favor of the years of teachers' teaching experiences (Table 5), it is almost an automatic consequence to have better practice-theory integrative content implementation from senior/first generation universities as they have accommodated mainly high and medium experienced teachers. A similar result is also found by the writers like Neill, Singh and Donoghue (2004) and Ernst and Young (2010). In fact,as Ernst & Young (2010) noted, better material resources (that first-generation universities might have) also have undeniable contributions for better practice-theory integration deliveries.

With regard to teachers' university teaching experiences, high and medium experienced teachers did better practice-theory integrative content implementations than low experienced teachers did. Medium experienced teachers (8-15 years of university teaching service) tend to have reasonably sufficient and basic organizational and professional culture (Daughtrey&Wieder, 2010) so as to work their teaching-learning effectively within the continuum. That is why their practice-theory integrative content implementation involvement did not show significant differences from their counterparts in the highly experienced teachers (16 and above years of university teaching service) (Table 5).

In general, this article has learned that experiences of individual teachers and the institutions/universities as well (see Table 3) have a power to determine engineering teachers' practice-theory integrative content implementation involvements with the favor of seniority in both (teachers and institutions) cases. That is why, for example, the second and third-generation universities which were established in minimal time range did not have significant differences in their teachers' practice-theory integrative content implementation involvements (Table 4) though first-generation university is excelled them. Similarly, medium and high experienced teachers, who have relatively sufficient experiences (greater than eight years) in university teaching, did better but not have significant differences in their practice-theory integrative content implementation (Table 5). Therefore, a reasonable number of teachers and institutions' experience seem to be important for better practice-theory integrative content implementation.

Practical content implementation had better contributions (35.02%) towards practice-theory integrative content implementation than theoretical content implementations (8.92%) did (Table 7). This result indicated that better practical content implementation will tend for better practice-theory integrative content implementation since it is easy to frame theoretical rules/patterns if someone can do its practical version in a better way (Schon, 1987; Higgs, 2011). That is possibly why both practical and practice-theory integrative content implementation endeavors together are below the expected mean while theoretical content delivery is above the expected mean (see Table1). In other words, the highest possible attempt of theoretical content implementation does not ensure the practical and practice-theory integrative content implementations even to their average position (see Table 1). From these findings one can learn that exhaustive theoretical content teaching-learning alone (of course without addressing its respective practical-contents properly) might not result even to ensure successful theoretical content learning. In other words, unless it is aligning with practical contents, the theory learning itself becomes incomplete. This assumption, particularly in engineering and vocational training, is shared by many writers like Sheppard and Sullivan (2007), Abdulla (2011) and Felder and Brent (2003). Felder and Brent (2003), for example, stated that engineering content learning (both theoretical and practical) will be effective if and only if the teaching-learning engagement plays along the continuum of theory and practice even by giving more attention to the practical ends of the content.

In general terms,according to the findings of this study, teachers' practical content implementation, which might be better addressed from practical, older and continuous teaching involvements, could be strengthened through better years of services of the teacher and the institution as well (Jamieson, 2007; Felder & Brent, 2003). This study also informed that practical content implementation in turn served as the best ground to have better performance in practice-theory integrative content implementation. Hence, as this study identified, it is possible to recognize that experiences of individual teachers and institutions will tend to have better performance in practical content implementation. Practical content implementation in turn, as the regression analysis of this study showed, has better contribution for practice-theory integrative content implementation and of course for better theoretical content learning as well (Abdula, 2011; David, 2015) since they are within the continuum.

Conclusions and Implications

Based on the analysis and discussions made above, the following conclusions are made.

- Engineering teachers' practical and practice-theory integrative content implementation involvements were below the expected performance though theoretical content implementation practice was in a better status.
- High and medium experienced teachers did better practice-theory integrative content implementations than low experienced teachers.
- Engineering teachers in the first-generation university performed best in implementing practice-theory integrative contents but

there was no significant difference between the second and third generation university teachers.

- The contributions of practical content implementation endeavors (35.02% out of the 43.94% multiple effect) of engineering teachers towards practice-theory integrative content implementation were good when compared with the theoretical content implementation involvements (8.92% out of the 43.94% multiple effect) did.

In general, it is possible to conclude that real experience is a basement rock for having better practice-theory integrative content implementations. That is why high and middle experienced teachers, First Generation University teachers and teachers with better exposition of practical content delivery experiences have contributed something better for practice-theory integrative content implementations.

Based on the findings obtained and conclusions derived, the following implications can be made:

- University engineering students, teachers, academic officers and industry owners/managers have to give the most possible attention for maximizing practical content implementations which the present study found as fertile ground to realize practice-theory integrative content implementations and for theoretical content learning as well. This can be actualized by making relevant and sufficient orientations about how much the practical content implementation is critically important for having better engineering graduates thereby to have better industry performances in the country. In order to ensure the practicality of this suggestion, engineering education main stakeholders (students, teachers, academic officers and industry owners/managers) primarily need to acknowledge the contributions of practical content implementationson practice-theory integrative content deliveries thereby to have better graduates in engineering. Therefore, extremely practical and hands on pedagogical training, which is in fact supported by video conferences, workshops and industry visits, should be designed and implemented via continuous, active and reflective manner. For this purpose, the university in general and the engineering institutions in particular should introduce and exercise sort of continuous professional development (CPD) package.

- The university has to arrange experience sharing between low experienced/beginner teachers and senior teachers, who accumulated lot of experiences that help to ensure better understandings and actions on the practical contents. This might be realized by encouraging engineering teachers to have critical professional groups so as to do visits among their classes, have friendly and academic-based supervision, accomplish pre- and post-classroom conversations, etc.
- Third- and second-generation universities have to make repeated visits at first generation universities for the sake of obtaining experiences in different perspectives (e.g. engineering workshops, equipment, technicalities, etc.) thereby to adapt it to their institutions. While the visit is going on, there should be well thought out strategies and instruments (e.g. check lists, interview/questionnaire/observation scale items) in order to have designed, concrete and data-based lessons. As a result, the experience sharing trip between senior and junior universities will become successful and transferable via reports, manuals, seminar presentations, etc. which might serve junior university teachers in meaningful manner. If not, the visit might be labeled as simple time, labor and finance wastages.

For better university engineering education, therefore, the institution in general and teachers and students in particular need to work in synchronizing manner among real teaching/industry visit experiences, practice-focused teaching-learning endeavors and then enhancing practice-theory integrative content implementation modalities.

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