

## Andragogical, Pedagogical and Lifelong Learning Orientations of Freshman Engineering Students in a Project-Based Course

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**Abstract:** This paper provides a comparison of andragogical and pedagogical orientations to learning, and argues that andragogy needs to be viewed as a principle for lifelong learning. Andragogical and lifelong learning assumptions are discussed from the perspective of engineering education in general and project-based learning in particular. The paper also presents the results of a small-scale study conducted on fifty-eight freshman engineering students' andragogical and lifelong learning orientations in the context of Khalifa University of Science and Technology, Petroleum Institute, Abu Dhabi in the UAE. Results showed that the students had a greater tendency towards andragogical orientations, and that they had a moderate level of lifelong learning orientation. Data also revealed a positive correlation between andragogical and lifelong learning tendencies, and a negative correlation between pedagogical and lifelong learning tendencies. The results of the study are discussed and recommendations are made.

Keywords: Andragogy, Pedagogy, Lifelong Learning, Project-based Learning, Engineering Education

### Birinci Sınıf Mühendislik Öğrencilerinin Proje Tabanlı Bir Dersteki Andragojik, Pedagojik ve Yaşamboyu Öğrenme Eğilimleri

**Öz:** Bu çalışma, öğrenmeye andragojik ve pedagojik yönelimlerin karşılaştırmasını ortaya koymakta ve andragojinin yaşamboyu öğrenme için bir ilke olarak görülmesini savunmaktadır. Yaşamboyu öğrenme ve andragojik varsayımlar genelde mühendislik eğitimi ve özelde de proje tabanlı öğrenme perspektifinden tartışılmaktadır. Çalışmada ayrıca, Abu Dhabi UAE'de Khalifa Bilim ve Teknoloji Üniversitesi'nde elli sekiz mühendislik öğrencisinin andragojik ve yaşamboyu öğrenme yönelimleri üzerine yapılan küçük ölçekli bir çalışmanın sonuçları sunulmaktadır. Araştırma sonuçları öğrencilerin andragojik yönelimlere daha fazla eğilimli olduklarını ve yaşamboyu öğrenme yöneliminde orta düzey olduklarını göstermiştir. Araştırma verilerinde, andragojik ve yaşamboyu öğrenme eğilimleri arasında pozitif bir ilişki olduğu; pedagojik ve yaşamboyu öğrenme eğilimleri arasında ise negatif bir ilişki olduğu ortaya çıkmıştır. Çalışmadan elde edilen bulgular tartışılmış ve öneriler geliştirilmiştir.

*Anahtar Kelimeler:* Andragoji, Pedagoji, Yaşamboyu Öğrenme, Proje Tabanlı Öğrenme, Mühendislik Eğitimi

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Given the incredible pace of scientific and technological developments, whether or not practicing engineers must improve their existing skills and acquire new skills is no longer even a discussion. It is also beyond any doubt that changes triggered by these advances challenge global well-being at individual and societal levels. Several attempts have been made to encourage organizations as well as individual members of the society to assume responsibility for continuous education so that these challenges can be tackled more effectively, and yet there is room for still more economic and personal growth. This has led to the arguments that learning cannot be confined to physical classrooms (Ofsted, 2008) or a certain age (McClusky, 1945; Zehr, 2013), with life itself being a venue for learning (Titmus, 1979). Out of these specific arguments and related ones emerged the term 'lifelong learning' (LLL), which has become a catch phrase in many disciplines, and engineering has not been immune to this discussion. Various national and international documents on engineering education have touched upon the requirement for LLL (ABET, 2013; Dutta, Patil & Porter, 2012). However, the characteristics of what makes an efficient lifelong learner do not seem to be at the heart of the discussion. Neither is there enough focus on whether or not learners' beliefs and learning orientations need to be identified. In addition, a lack of interest in the characteristics of adult learners engaged in LLL results in little to no use of adult education terminology in the field. Pedagogy, the literal definition of which is 'the art and science of *teaching* children' (Knowles, 1973, p. 40), is used much too broadly and dominates talks on LLL.

The main impetus for the current paper results from this identifiable gap in the literature. It will be argued that 'andragogy', a term commonly used in adult education, and LLL overlap to a great extent. Yet, they seem to be used in isolation from each other. There will also be some discussion on how the project-based learning (PBL) approach in engineering education develops students' LLL skills, and how relevant andragogy is to engineering education. To this end, we will describe two PBL-based courses at Khalifa University of Science and Technology, Petroleum Institute in Abu Dhabi. We will argue that these courses provide students with opportunities to learn and use LLL skills. Although andragogy does not seem to appear in the lexicon used by the faculty or in the teaching materials, its pillars are targeted indirectly through LLL-friendly curricula used in both courses. However, it may not always be appropriate to assume that students, whether adults or young adults at college, are andragogically or LLL oriented despite the emphasis put on both. Therefore, it seems necessary to identify learners' orientations so that suitable teaching/learning interventions can be planned. With this in mind, this research is intended to shed at least some light on freshman engineering students' learning propensities. In addition, empirical evidence is necessary to support our assumption that lifelong learners are andragogically-oriented. This research is an attempt to identify if such evidence exists.

### **Purpose of the Study**

For the above-mentioned reasons, this study aimed to determine the andragogical and lifelong learning orientations of freshman engineering students. It also aimed to identify the

association between these students' andragogical and LLL orientations. With these purposes, the study sought answers to the following questions:

1. What is the extent to which freshman engineering students are andragogically-oriented?
2. What is the extent to which freshman engineering students are LLL-oriented?
3. What kind of correlation is there between the students' andragogical and LLL orientations?

### Literature Review

#### Andragogy

Defined as "the art and science of helping adults learn" (Knowles, 1980, p. 38), andragogy is regarded as distinct from pedagogy which is traditionally defined as "the art and science of educating children" (Knowles, 1980, p. 38). The Greek stem word 'andra' in the term andragogy means 'man, not boy', or in other words 'adult', and 'agogus' means 'leader of'. Taken together it means the leader of adults (Knowles, 1980). However, pedagogy stems from the Greek words 'paid' meaning 'child' and 'agogus', the combination of which means the leader of children (Knowles, 1980). This comparison suggests that, to avoid confusion, educators need to be clearer with the terminology they use. Table 1 below further compares the learning-related concepts according to pedagogical and andragogical assumptions.

**Table 1**  
*Andragogical Assumptions versus Pedagogical Assumptions*

Concepts	Andragogical assumptions	Pedagogical assumptions
The learner	Increasingly self-directed	Dependent
Role of learner's experience	A rich source for learning by self and others	To be built on more than used as a resource
Readiness to learn	Develops from life tasks and problems	Uniform by age-level and curriculum
Orientation to learning	Task or problem-centered	Subject-centered
Motivation	By internal incentives and curiosity	By external rewards and punishment

Knowles (1992, p. 12)

As is indicated in Table 1, a pedagogical orientation to learning and teaching assumes that students are dependent on the teacher, and that what counts is the subject matter rather than problems faced by the students at a particular time. Students' lack of experience is argued to prevent incorporation of their past experiences into the learning environment. Students are perceived as immature and the focus is on young or immature students' socialization processes (Yoshimoto, Inenaga & Yamada, 2007). Considering these differences,

the role of the teacher in the andragogical model shifts towards that of a facilitator who works together with learners in diagnosing needs, deciding on objectives based on those needs, designing learning experiences supported by suitable techniques and materials as well as evaluating learning outcomes (Knowles, 1973, p. 54).

Despite the distinctions made between andragogy and pedagogy, the reality of a dichotomy between the two concepts has been the topic of much discussion. Hanson (2010) asserts that there is little real evidence that adults and children have totally different orientations to learning. She acknowledges the fact that factors such as age and experience play a role, but warns that their significance may be overrated and therefore misleading. Greater age does not necessarily predict more experience, thus requiring educators to consider more specific characteristics of each individual learner, the content matter, the learning setting, the relationships between learners and teachers, and the learners' peers (Hanson, 2010). Research has also shown that not all adult learners have a strong andragogical orientation, and some in fact may be more pedagogically-oriented especially if they have been exposed to pedagogical assumptions over an extended period of time (Deveci, 2007). It has further been suggested that an orthogonal approach to andragogy and pedagogy would allow individual learners to be placed "within a two dimensional space that is bounded on one side by andragogy and on the adjoining side by pedagogy" (Delahaye, Limerick & Hearn, 1994). As classroom practitioners, some teachers also observe that school children are generally impatient to apply their knowledge immediately like adult learners (Nikolova, Malcheva, Stefanova & Boytchev, 2013). These teachers therefore note that the shift from subject-centeredness to problem-centeredness in school teaching is unavoidable, and that students do not want to be passive in their learning, but instead to participate as soon as possible. This requires teachers of school children to create active learning environments where students assume responsibility for their own learning so that they are internally motivated, as is the case in the andragogical approach.

In response to arguments on the distinctions as well as the overlap between andragogy and pedagogy, new models have been developed. One of these is the 'pedandragogy', a synthesis of the core elements of both approaches promoting the development of learning environments compatible with self-engaged learning by learners of all ages (Samaroo, Cooper & Green, 2013). Another term coined to blend the two concepts is 'metagogy', which advocates blending various aspects of pedagogy and andragogy "in a way that meets the needs of adult learners depending on their needs in a specific educational context" (Peterson & Ray, 2013, p. 80).

### **Lifelong Learning**

The early conceptual foundations for lifelong learning (LLL) can be found in the writings of Plato, although John Dewey, Eduard Lindeman and Basil Yeaxlee were the first scholars who adopted a systematic approach to the concept arguing that education cannot be

divorced from life itself (Ayhan, 2006). Influenced by this particular orientation to learning, UNESCO stated that LLL stems from

... the concept that education is not a once-for-all experience that is confined to an initial cycle of continuous education commenced in childhood, but a process that should continue throughout life. Life itself is a continuous learning process, but each person needs specific opportunities for continuing, purposive and sequential learning in order that he or she may keep abreast of technical and social change, may equip himself or herself for changes in his or her own circumstances ... (Titmus, 1979).

UNESCO's explanation of the concept highlights the organizational and purposeful aspect of LLL learning, not leaving education to chance. This requires various organizations such as schools, universities and local administrations to assume certain responsibilities of organizing and offering citizens the opportunities for LLL. Beairsto (2000) observes that organizational training programs focus on what learners know rather than on future developments, and training offered now is likely to be out of date by the time the target content and skills are implemented. He notes that individual members of organizations are required to learn and unlearn on their own so that they can keep with rapid changes, and tackle unexpected situations. Only in this way can they adapt to changes, survive challenges and contribute to the shaping of their organization's future. Therefore, individuals should take responsibility for assuming active roles in learning for their own and their organization's sake. This requires lifelong learning skills, "refer[ring] not to the specific information that students acquire during their formal education, but to how successfully they can continue to acquire information after their formal education has ended" (Dong, 2004, p. 75). Love (2011) lists the requisite skills as follows: (a) taking responsibility for planning a professional career path, (b) understanding the role of professional organizations in lifelong learning, (c) seeking certifications associated with one's profession, (d) self-assessing, asking others to assess himself/herself, reflecting and taking learning action based on assessment and reflection, (e) remaining current in one's field and taking responsibility for identification of knowledge deficiencies and learning opportunities, (f) knowing criteria used to evaluate performance and professionalism, (g) having a multiyear professional development plan, and (h) having learning interests outside one's profession and pursuing those with vigor.

Duman (2007), who approaches the concept from the literacy perspective, argues that lifelong learners need to possess the traits attributed to knowledge-literate people as the foundation for LLL. Some of these traits are as follows: (a) making informed decisions based on knowledge, (b) deciding their knowledge needs and figuring out ways of addressing those needs, (c) defining potential sources of knowledge, (d) evaluating the accuracy and usefulness of knowledge they gain, (e) organizing and storing knowledge, and (f) integrating new knowledge with what already exists and using it to deal with problems and challenges.

### **Andragogy and Lifelong Learning: Two Sides of the Same Coin?**

Reischmann's (2005, p. 58) definition of andragogy is based on the concept as "the science of the lifelong and lifewide education and learning of adults." Similarly, Henschke (2013, p. 38) defines LLL as follows:

[An] ... andragogical principle regarded as the continuous and never complete development, changes, and adaptation in human consciousness including learning that occurs partly through deliberate action of Non-Formal, Informal, Formal educational systems, but even more as a result of the business of living; and, may be intentional or unintentional that includes acquiring greater understanding of other people and the world at large, based on six pillars of learning: learning to live together, learning to know, learning to do, learning to be, learning to change, and learning for sustainable development.

These definitions indicate that andragogy acts as an overarching principle for LLL and, therefore, provides guidance for LLL practices. In the same vein, Kessels (2015) perceives "andragogy as a science of understanding and supporting lifelong learning" (p. 15). In this sense, the two concepts appear to be inclusive of each other for many reasons, although they cannot exactly be considered 'two sides of the same coin'. First, both emphasize the concept of the individual as a self-directed learner. An andragogical approach assumes that learners would prefer to actively engage in setting goals, and identifying the best ways to achieve these goals using particular learning methods, all of which indicates self-control over learning (Knowles, 1992). Learning can occur in formal contexts; however, most learning takes place in informal contexts, which is one of the tenants of LLL as well. In order to succeed as learners, LLL requires learners to take control of their own learning just as andragogy suggests they should. To help this happen, in both approaches an instructor's role shifts from being a teacher to that of a facilitator guiding the learner where and when necessary. Second, in both approaches learners' experiences play an essential role in providing a source for learning. In the andragogical orientation, learners are believed to have had previous life-experiences from which they have learned and on which they can build. Should they feel that these experiences are not welcomed, they may feel rejected as individuals (Crawford, 2004). Similarly, LLL puts the learner's experience at the center of learning. Passarelli and Kolb (2012) note that LLL does indeed require learners to be able to learn from their life experiences. They say that this can be facilitated through students' engagement in experiential learning which provides them with a roadmap of how learning occurs, what they are like as learners, and the nature of the spaces in which learning takes place. Having experienced this roadmap, they can fully enjoy life events as a source for learning. Third, the problems learners currently face and the life-tasks they assume are regarded as the main motivation for learning in both approaches. However, LLL also aims at equipping the learner with the necessary skills to tackle problems and life-tasks learners may have yet to face. In this sense, LLL can be regarded as future-oriented. Last, both andragogy and LLL regard intrinsic motivation as the key to learning. The primary responsibility for

motivation lies with the learners themselves for learning to be successful, and their thirst for knowledge should act as an internal motivator to sustain engagement in the learning process (Pew, 2007). Taken together, the similarities between the two concepts noted above indicate that they are married to each other and that they could be used interchangeably despite certain attributes which one might emphasize more than the other.

### **Lifelong Learning and Andragogy in Engineering Education**

In order to survive in a competitive world of engineering, just like in any other discipline, practicing engineers need to adapt to the constant changes and developments caused mainly by technological advances. This requires them to have LLL skills (Deveci, 2014). Therefore, engineering faculties need to foster students' LLL skills, which they are normally expected to be familiar with even before they embark on their engineering education. This is particularly important for faculties seeking accreditation from the Accreditation Board for Engineering and Technology (ABET), which states that engineering students should have 'recognition of the need for, and an ability to engage in life-long learning' (2013). Parkinson (1999) notes that such recognition can only be fueled by the individuals themselves since it really needs to be something they choose to do rather than having it imposed upon them, and this requires them to take the full responsibility for their own continued learning. He states that this attribute in undergraduates can be developed during their studies using a broad strategy including (1) communicating expectations, (2) expecting students to take responsibility for their learning, (3) providing learning opportunities outside the classroom, (4) providing motivation for students, and 5) teaching students about how to learn.

Based on the argument that the curricula in most engineering programs are overloaded and therefore there is little time or effort for developing the LLL skills required for students to become successful learners for a lifetime (Beston, Fellows & Culver, 2001), DiDomenico (2010) underlines the need for all engineering faculty to be provided with information and support to transform their curricula into ones that incorporate LLL concepts and teaching/learning opportunities. He suggests that they can do this through lectures, reference materials, internet resources and/or a combination of them all. This, he believes, would encourage students to adopt a strategic approach to learning and to incorporate the newly introduced concepts into their thinking. The complex tasks engineering students are assigned can be purposefully designed to produce experiences that extend learning by moving students out of their comfort zone with focus, that exercise both goal setting and task identification skills, and that allow for peer review, milestone monitoring and process iteration if necessary (DiDomenico, 2010). Similarly, Dutta, Patil and Porter (2012) suggest that engineering departments should develop a variety of LLL programs housing classes, seminars and workshops with different delivery methods. To this end, they note that academic committees should be created at universities to develop a variety of courses for practicing engineers too.

### **Project-Based Learning Embracing Lifelong Learning and Andragogical Assumptions**

Project-based learning (PBL) has its roots in the constructivist approach to learning, which suggests that learning occurs by constructing new ideas and/or concepts based on existing knowledge and previous experience (Karlin & Vianni, 2001). John Dewey (1938), a constructivist psychologist and educator, wrote extensively on experiential learning arguing that experience needs to be linked to education in order for learning to be meaningful. He stated that learning does not take place in a vacuum. Rather, it should be planned around experience with meaning. David Kolb (1984) took this approach to learning and developed the concept of project-based learning (PBL) which is based on the argument that “learning by doing... increases student motivation while improving students’ problem-solving and higher-order thinking skills” (Boss & Krauss, 2014, p. 16). To this end, the PBL approach engages students in open ended questions, and application of knowledge in an attempt to produce authentic products (Boss & Krauss, 2014). The teacher takes the role of a facilitator helping students frame meaningful questions, planning meaningful tasks and assessing learning from the experiences (David, 2008).

The nature of PBL requires and allows for andragogical and LLL orientations. First, student accountability and ownership emphasized in PBL requires individuals to explore issues they are genuinely interested in (Seideman, 2015). Topics chosen by students themselves, with the teacher’s guidance when needed, will foster intrinsic motivation since they have their roots in natural curiosity (Bell, 2010). Similarly, andragogically oriented lifelong learners would be expected to be problem and interest-centered. They like to produce solutions to issues they face; therefore, they are more motivated to participate in the learning processes actively. Goal-setting is another skill endorsed by all the three approaches. In a PBL environment, students are guided to set realistic and achievable goals (Seideman, 2015). Similarly, LLL requires that learners should avoid too challenging or too easy targets to eliminate boredom and failure (Lüftenegger et al., 2012). Andragogically oriented learners and facilitators cooperate in formulating learning objectives and goals based on individual needs and interests (Knowles, 1980).

The learner autonomy highlighted in PBL is also evident in andragogy and LLL. According to Knowles (1975), learners take the responsibility for the diagnosis of learning needs, the goal-setting, the identification of the required resources, the use of carefully-chosen learning strategies and the evaluation of the learning process. Dunlap (2005) notes that adapting to and participating in change as an LLL skill requires self-directedness in that learners are expected to “understand, prepare for, embrace, and enhance change” (p. 8). This, Dunlap points out, helps lifelong learners to identify their strengths and weaknesses and undertake appropriate remediation. By giving the control over learning to the individual learner, PBL promotes LLL (Ozel, 2013).

The collaborative nature of PBL is also reflected in andragogy and LLL. Although students may take on individual tasks, PBL is a collaborative learning approach that engages students in group/team work requiring all the members to participate and interact with



other students (Ozel, 2013). Interaction between students in the team requires exploitation of a variety of communication skills (Kotze & Cooper, 2000). Atkinson (2001) observes that one of the most important skills in a PBL environment is 'people skill', which would involve "tolerance, willingness to help, communication, negotiation, acceptance, [and] persuasion" (p. 3). An andragogical approach also assumes that adults learn better when they collaborate and work in teams. Simulation, a technique often used in andragogically-friendly learning environments, gives learners the opportunity to use a variety of skills and behaviours in small teams, which results in greater motivation for learning (Zigmont, Kappus & Sudikoff, 2011). It has also been shown that students in a course designed according to andragogical orientations can indeed participate in active learning within their own teams as well as across teams, allowing them to learn from each other's experiences by sharing of ideas (King & Malhotra, 2001). Team-work would also enable learners to share the workload and disseminate information more quickly helping them achieve their goals more easily (Johnson, Johnson & Smith, 1991). Considering the problem-centeredness in the andragogical model, the role of team-work in attaining goals appears to be of particular importance. Similarly, lifelong learners are required to acquire certain soft skills as well as hard-skills in any field. Defined as "skills that are positioned, by employers, as necessary attributes for successful employment" (Tummons & Ingleby, 2014, p. 131), employability skills as an attribute of LLL, include various soft-skills, one of which is teamwork. Students working together also get the opportunity to acquire social skills that are necessary to function well in society. They learn and practice etiquette needed at school, at work and in society at large. These skills contribute to the attainment of the objective of social inclusion and employability described by the European Commission (2001).

### **Research Context**

This research was conducted at Khalifa University of Science and Technology, Petroleum Institute (PI) in Abu Dhabi, UAE. PI is an engineering university offering undergraduate courses in the fields of Electrical Engineering, Chemical Engineering, Mechanical Engineering, Petroleum Engineering, and Petroleum Geosciences. It also offers several Master of Engineering and Master of Science degrees. Sponsored by the Abu Dhabi National Oil Company (ADNOC), the university's mission is to "provide high quality engineering and science professionals through a continued commitment to excellence in its undergraduate and graduate academic programs alongside fundamental and applied research serving the Oil, Gas and Energy sectors' need for talent, solutions and advanced technical innovations that contribute to the UAE society and economy" (PI WEBPAGE). Since PI is accredited by ABET, it is required to address several criteria, one of which is related to instilling LLL skills in students: 3i –"recognition of the need for, and an ability to engage in life-long learning" (ABET). With this mandate, the curricula in all courses include a learning objective related to teaching LLL skills.

The principle author of this paper teaches in the Communication Department under the College of Arts and Sciences. The Communication Department assists the university in reaching its aim of training engineering students to be creative and critical professionals in

producing solutions to a variety of engineering problems. With this purpose, the department offers two courses (COMM101 & COMM151) aiming at producing lifelong learners. COMM101, a prerequisite for COMM151, is more of an introductory course to the notion of LLL, while COMM151 builds on the skills students are exposed to in COMM101. Both of these two courses aim to contribute to the university's aim of equipping students with LLL skills required for them to function as successful engineers upon graduation. To this aim, the courses adopt PBL as their main approach to teaching and learning. In these courses, students are required to carry out term-long projects of their choice. While COMM101 students are encouraged to choose topics on issues they may face as freshman students (e.g. time-management, studying in a foreign language and adaptation to college life), COMM151 students are required to study technical topics of general interest such as recycling and waste-management, which are expected to raise their schemata about engineering related topics. In this way, students are provided with opportunities to engage in real-life experiences and meaningful learning activities. They are guided to become self-directed learners looking for relevant sources of information, ways of collecting data to answer research questions and discussing the significance of their data in the light of the knowledge already available. The fact that they are required to conduct their project in teams also help them acquire interpersonal skills. The instructor assumes the role of a facilitator, providing guidance where and when necessary. The instructor also acts as co-learner with the students since the type of project topics may not always be familiar to him/her. In this way, both the instructor and the students assume responsibilities for each other's learning. The instructor is no longer the absolute holder of knowledge, but is just another active participant in the learning process. This builds students' self-confidence and further reinforces their feeling of control over their own learning as well as that of their peers.

Taken together, these qualities of the courses indicate several areas in which COMM courses embed andragogical and lifelong learning assumptions to learning. First, although students are offered with training on conducting research and writing up a research report, they are essentially regarded as self-directed learners, and guided to assume greater responsibility for learning as the courses progress. Second, their choices of topics for their projects are usually affected by the kind of issues they face as freshman students, which indicates its relevance to andragogical assumption on the role of life tasks and problems. In addition, their engagement in the projects requires them to reflect on their own and peers' experiences that are regarded as a rich source for learning. This is assumed to create more interest in the whole-process, with motivation coming from within. This, however, is not to rule out students' externally aroused motivation for a passing-grade. In this sense, the relationship between andragogical and pedagogical orientations is considered in the design and execution of the courses. Students' engagement in team-work throughout the courses also underlines the role of collaborative learning in both andragogy and LLL.

## Methodology

### The Subjects

A total of 58 male students registered in the principle researcher's COMM151 classes participated in this study. Therefore, the study relied on a purposive sample. The ages of the students ranged between 18 and 22, with the mean age of 19. The majority of the students (80%) were UAE citizens, 12% came from Palestine, while 8% of them came from other Arab countries including Jordan, Yemen and Oman.

### The Instruments and Analyses

Data were collected using two questionnaires:

- a) Educational Orientation Questionnaire (EOQ): Developed by Christian (1983), this questionnaire contains 25 andragogical and 25 pedagogical statements. Respondents are asked to indicate the extent to which the statements apply to them. Its reliability was tested by Christian using the Kuder Richardson Formula which yielded a reliability coefficient of 0.77. On the other hand, its content validity was tested and approved by a jury including Malcolm Knowles. The maximum score for the questionnaire is 250 while the minimum score is 50. A median of 150 is considered neutral in a respondents' educational orientation. Scores over 150 are considered andragogical while scores under 150 are considered pedagogical.
- b) Lifelong-Learning Tendency Scale (LLTS): Originally developed in Turkish by Coskun and Demirel (2012), an English version of LLTS was used to identify students' lifelong orientation levels. Deveci (2014) translated the instrument into English and had three native speakers validate the translation. The translated version was translated back into its original language to ensure that original meaning of the items was not lost. The new version of the instrument was piloted on ten PI students to ensure validity and reliability. The Cronbach' alpha internal consistence coefficient of the scale was determined to be 0.89. The maximum score for the scale is 162, and the medium score is 94.5.

The Student's T-test was used to identify the statistical significance levels comparing the scores from EOQ and LLTS. The Pearson product-moment correlation coefficient ( $r$ ) was used to measure the strength of association between the EOQ scores and the LLTS scores of the students. A p-value of less than 0.05 was considered statistically significant for all the above-mentioned tests.

## Results

The first research questions aimed to identify whether the students had andragogical or pedagogical orientations to learning. The results of the data analysis conducted for this purpose can be seen in Table 2.

**Table 2**  
*Andragogical and Pedagogical Orientations of Students*

	Minimum	Maximum	Average	SD	p*
Andragogy N=49	146	175	159.14	8.7487	0.00001
Pedagogy N=9	134	149	143.22		

\*p < 0.05

As can be seen in Table 2, the greater percentage of the students (86%) were andragogically-oriented, and the mean for the andragogical items was 159.14, which indicates a moderate orientation. This finding shows that the freshmen engineering students in general tended to have a greater orientation for andragogy. That is, as learners they were more self-directed. It is likely that they also perceived their own and their peers' life experiences as a learning source, which helps them prepare for learning situations. Data also indicates that the students were task or problem-centered in that they were more eager to learn things that would help them tackle issues they faced or carry out tasks they were assigned by their instructors. This naturally translates into intrinsic motivation. Students' moderate level of andragogical orientation suggests that these students were still yet to assume a total andragogical approach to learning. On the other hand, data also shows that 14% of the students were pedagogically-oriented. This suggests that these students were more dependent on their instructors, and they were more subject-oriented than tasks or problem-oriented. They were also motivated by external rewards such as course grades. The difference between the andragogically and pedagogically-oriented students was at a statistically significant level ( $p=0.00001 < 0.005$ ).

The second question aimed to identify the students' lifelong-learning orientations. Table 3 below presents the results of the data analysis related to this question.

**Table 3**  
*Students' Lifelong-learning Orientations*

	Minimum	Maximum	Average	SD
N=58	87	136	109.6	11.8217

Table 3 shows that the students' average LLL orientation level was 109.6. This was a moderate LLL orientation, indicating the students had not yet fully become ready for LLL. However, they still exhibited some skills of persevering in the face of difficulties with learning. They could identify the sources of problems and tackle them with some efficiency. This also suggests that they had the potential to evaluate the usefulness of sources that would help them achieve learning aims. The average level of LLL orientation also indicates that students had some interest in learning that may not be directly relevant to their studies. It is possible that they did this with the belief that all learning is useful, and may be useful in other situations.

The last research question concerned the correlation between the students' andragogical, pedagogical and lifelong-learning orientations. The results of the data analysis regarding this can be seen in Table 4.

**Table 4**  
*Pearson Product-Moment Correlations of Andragogical, Pedagogical and LLL Orientations*

	Lifelong-learning orientations
Pedagogical orientations	-0.0571*;0.8841**
Andragogical orientations	0.0283*;0.0487**

<sup>a</sup> Values are product-moment correlation coefficient (r); p

\* r < 0.01 (2-tailed)

\*\*p < 0.05 (2-tailed)

According to Table 4, the correlation coefficient (r) for the pedagogical and LLL orientations equals -0.0571, indicating a weak negative relationship. This suggests that students' LLL orientation scores tend to decrease as their pedagogy scores increase. Although the p value of 0.8841 indicates that the relationship is not at a statistically significant level, the negative correlation between the pedagogical and LLL orientations indicates that those with a LLL-orientation were more self-directed than those with a pedagogical orientation. It is also important to note that a pedagogically-oriented student may value learning more when there is an external reward, unlike a student with a LLL orientation. The negative correlation between the two variables also indicates that students become more problem oriented as they increase their LLL propensities. Learners' experience also becomes more valuable as students shift from the pedagogical orientation to the LLL orientation.

Table 4 also shows that the correlation coefficient (r) for the andragogical and LLL orientations equals 0.0283, which indicates a weak positive relationship. That is, the higher students score for LLL, the higher their andragogy scores tend to be. The p value of 0.0487 also indicates that the relationship is at a statistically significant level. This data has several indications. First, both andragogical and LLL orientations value students' active role in learning. That is, lifelong learners are expected to assume greater responsibility for learning, which is also indicated in their andragogical orientation. Second, as students gain LLL skills they acquire experiences that contribute to their learning. This in turn increases their aptitude for the andragogical orientation, which sees learners' life experiences as valuable learning sources. Third, their readiness for learning based on life tasks and problems appears to be correlated in both orientations. Finally, both andragogical and LLL orientations seem to emphasize student motivation that is triggered by internal incentives and curiosity. However, the weak positive relationship indicated by the correlation coefficient (r) computed for the data set (0.0283) indicates that the association between the two orientations still needs to be strengthened. Considering students' relatively brief time at university, the association can be expected to improve as they gain more experience as college students.

### Discussion

The results of this study showed that the students were more andragogically-oriented than pedagogically-oriented. However, their andragogical orientation was at a moderate level (159.14). This could still indicate the students' tendency towards self-directed learning.

They could be relatively more prepared for taking an active role in learning by making decisions on what to learn, how to learn and evaluate it, which are among the key skills andragogically-oriented learners possess (Knowles, 1992). The tasks they are assigned in their PBL-based Communication course is also likely to shift their orientation to learning from subject-centeredness to task/problem-centeredness. Taken together, students' tendency for self-direction, use of life experiences and task/problem centeredness is consistent with the constructivist perspective of learning (Blondy, 2007).

Similarly, the students had a moderate level of lifelong learning (LLL) orientation (109.6). This finding echoes the results of previous research in the same institution (Deveci, 2014), which revealed that other PI students' self-regulation and perseverance scores in particular lowered their overall LLL scores. These indicate that the freshman students in the institution were yet to adopt strong andragogical assumptions for learning. This was despite their relatively higher scores for curiosity and motivation sub-scales. Considering their relatively short history at college, these results may be expected. That is, secondary education in the UAE is observed to value rote learning and content memorization (Crabtree, 2010), which would inhibit students' development of LLL orientations. However, UAE authorities have also called for action to change rote learning in the UAE education system and provide students with opportunities to develop self-confidence and self-reliance through initiatives instilling motivation in them (Al-Banna, 1997). Regardless, freshman students would likely still have pedagogical tendencies at the outset of their higher education. Having said that, Khalifa University's educational underpinnings, embedded in the curricula at the College of Arts and Sciences (CAS), require students to be active agents of their own learning processes. For example, the project-based learning nature of the Communication courses in the College engages students in active learning experiences through the investigation of real-life problems students choose. They are encouraged to capitalize on the life experiences and skills they already possess; this reflects the underpinnings of LLL and the andragogical approach related to the role of learners' experiences and task/problem-centeredness (Knowles, 1992). The students' choosing of project topics is also expected to create intrinsic motivation in them, reflecting the andragogical assumption of curiosity and internal incentives (Knowles, 1992). This likely creates an internal motivator to help sustain their engagement in the learning process (Pew, 2007). The positive effects of PBL on increasing andragogical orientations have also been identified by previous research in other contexts (Pembbridge & Paretti, 2013).

It can be argued that students' PBL experience in their Communication courses at the PI helps them acquire some andragogical orientation. Learning outcome (SLO) 7 at CAS requires students to engage in development of LLL skills. To this end, CAS departments developed course-learning outcomes (CLOs). For instance, the Communication Department cultivates these skills through projects students conduct. For this purpose, students need to use academic literacy skills requiring them to locate and organize topic-relevant sources of information either from the library and/or on the World Wide Web (COL4). The communication courses also require students to collaborate and cooperate (COL2). These

requirements highlight the need for students to adopt LLL and andragogical orientations towards learning. Taken together, these may be considered as factors contributing to students' early development of andragogical orientations as freshman students. Given the opportunity in their future courses as well, it seems highly likely that they will have a greater tendency towards andragogy and LLL (Litzinger, Wise & Lee, 2005; Coskun & Demirel, 2012).

It is also important to note the results of this study related to the negative correlation between students' pedagogical and LLL orientation scores ( $r=-0.0571$ ), and the positive correlation between their andragogical and LLL orientation scores ( $r=0.0283$ ). These results indicate that students with higher levels of pedagogical orientation are less likely to engage in LLL activities. Raible and Jacoby (2013) note that individuals' readiness for LLL is dependent on their past preparation as well present engagement. This indicates that students' intense pedagogical experience inhibits the development of their LLL skills. Therefore, it is natural that a negative correlation occurred between the students' pedagogical and LLL tendencies. This is particularly important to note since higher education needs to be geared towards cultivating lifelong and lifewide learners who control their own learning and have a sustainable desire for personal and professional development. It seems that this would not be possible in a primarily pedagogically oriented learning environment where students assume the role of passive receivers of knowledge from professors in large lecture rooms. Nevertheless, this is still observed to be the case in classes at many higher education institutions, with a negative impact on students' learning necessary skills and changing attitudes (Jeffries, 2010). For students to acquire LLL skills, however, there need to be opportunities for active learning where students seek solutions to everyday problems through self-directed learning, thus challenging themselves to engage in learning activities based on their own experiences (Schweinfurth, 2007). This also highlights the andragogical assumptions that learners need to be active agents of their learning, and that learning experiences need to be based on problems faced in real life (Knowles, 1992; Passarelli & Kolb, 2012). It is not surprising that students who are treated in andragogically appropriate ways are more likely to acquire LLL skills. There is overwhelming agreement that students are better prepared for LLL if faculty members assume the roles of a facilitator, collaborator, and organizer, with this positively affecting students' employability when they have to work in fields requiring them to regularly learn new skills and knowledge (Using active learning in the classroom, 2011). Taken together, the results of this study suggest that andragogically-friendly learning environments likely predict greater LLL aptitude in students.

### **Limitations of the Study and Suggestions for Future Studies**

One of the limitations of this study stems from the sampling method. It included only male students. This was because of the nature of the context of the research at Khalifa University's PI gender-segregated campuses. The principle author of this current study taught only male students when the research was conducted. Future researchers could consider including female students as well, which could allow for a comparison between

genders. Another limitation of this study is the sample size. The research included only the students in the researcher's own classes. Therefore, the results of this study cannot be generalized to a wider population, probably not even in the context of Khalifa University. Targeting a larger sample size in future studies would therefore provide a fuller picture. Related to the limitation of sample size is the exclusion of COMM101 students from the study. Future researchers could include students from different levels, thus providing potential indications of possible development across terms and academic years. Alternatively, a longitudinal study focusing on a particular group of students could shed light on how they develop their andragogical and LLL orientations as well as possible reasons for this development.

### **Closing Remarks**

This study aimed to determine the andragogical and lifelong learning tendencies of freshmen engineering students. Andragogy, defined by Knowles as "the art and science of helping adults learn" (1980), consists of certain assumptions about learning. Lifelong learning has conceptual content such as learning from experience, connected with more practice. In this sense, it can be argued that lifelong learning overlaps with andragogical assumptions and also that andragogy is a practical guide to lifelong learning. It is also important to note that project-based learning necessitates andragogical and lifelong learning orientations. Suggestions developed in the light of the findings of this study on the andragogical and lifelong learning tendencies of freshmen engineering students are:

1. Considering the comparatively higher andragogical tendency of participants, undergraduate programs should take andragogical tendencies into consideration in addition to developing students' lifelong learning skills.
2. With reference to participants' moderate tendency towards lifelong learning, it could be argued that consideration of andragogical assumptions in the learning environment will strengthen these lifelong learning tendencies.
3. With reference to a positive relationship between lifelong learning and andragogical tendencies, undergraduate programs would be more likely to create effective learning environments if they were to include learning methods such as self-directed learning and learning from experiences.

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