A METACOGNITIVE INSTRUCTIONAL APPROACH AND SELF-REFLECTION: REFLECTIVE PRACTICE FROM A COMPUTER SCIENCE PERSPECTIVE

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ABSTRACT

Teaching is increasingly complex work which takes time to plan and continuous effort to ensure the highest standards of professional practice. There is a paradox in our rapidly changing society that educators are not very open to change in their practice (Hoban, 2002). The process for educators to learn and acquire effective teaching skills is a labour which has to be mastered over time. They would gain pedagogical knowledge and skills based on accumulation of new acquired knowledge and teaching methods and strategies to be added to their repertoire of existing knowledge and skills. In addition, it is vital for educators to utilize two aspects of reflective practice as suggested by Schon, which are 'reflection in action' and 'reflection on action' (Schon, 1983, 1987). Reflection in action refers to quick thinking action which takes places when one is teaching in the classroom. On the other hand, reflection on action usually takes place after the lesson out of the classroom when the educator reflects on his or her previous teaching and considers certain situations from the lesson again. Educational system in the 21st century encompasses reflection from both the teachers and students' perspectives. In general, reflective practice in teaching and learning in undergraduate education focuses on the professional development of students and academics in an interdisciplinary education. Reflective practice has been in existence in most professional educational practices for several centuries. The use of reflective practice in computing education courses has significant benefits to enhance the knowledge of the students. However, there is some controversies on how this reflection was done and the manner in which this was done based on individual teaching practice. One of the main objectives of this study is to describe the various approaches used in teaching undergraduate students in a computing course. The study illustrates several modern approaches used during this classes. A qualitative research method was applied in gathering the feedback from the students using a general survey questions based on the course delivery. The study used statistical packages for the social sciences (SPSS) to analyze the data gathered. The results revealed the various level of acceptance of the teaching methods applied in the course. These results also demonstrate significant findings on the students' opinions and criticism which could help in future improvement of undergraduate computing curriculum. The study, firstly review literature on reflective practice. Secondly, discussed some of the good teaching practices and methods used in delivery the classes. Thirdly, the analysis and results obtained from the instrument questionnaires used for this study and finally, summary of the findings and further research directions.

INTRODUCTION

The theories and principles of reflective practice has been used in education for over the centuries. Research has shown that learning and perceptions in the traditional educational system could in most cases be motivated from the students' perspective and interest in the subject (Marton & Booth, 1997, Gibbs & Habeshaw, 1992). The students mastering of the concepts during the lecture is of great significance to enhance the learning process (Salter et al. 2017, Fry, 2009).

Kolb (1984) suggests that reflective practice is part of the learning cycle which focuses on four stages. Research by Kolb (1984) argues that learning starts from everyday experiences people go through. In line with this, reflection is an integral part of such learning. The four stages in the Kolb's learning cycle are as below:

Stage 1 – Concrete experiences: experiences we can learn from
Stage 2 – Reflective observation: thinking about what was done and experienced
Stage 3 – Abstract conceptualization: understand the meaning of our experiences and generate a hypothesis
Stage 4 – Active experimentation: 'test' the hypotheses that have been adopted from new experiences

Teaching and reflection could be seen from two dimensions; teachers' delivery of the course and students reflecting on the understanding of the concepts which is the most crucial part of any educational system. Lectures should be student oriented and students should be involved during the lecture by way of class contributions. By engaging in classroom interaction and working together on tasks, students might acquire and develop a critical reflection and thinking (Johnson et al. 2011). It is important to allow students to contribute during the lecture to enable them to improve their communication skills and acquire new transferable skills. The students' needs and aspirations are the most important factor in any educational system (Onah et al. 2015). Reflection has been one of the focal points for most professional development across several multidisciplinary educational dimensions (Onah et al. 2015, Cornford, 2002, Loughran, 2002, Ottesen, 2007, Parson & Stephenson, 2005). Reflective practice is noted to be a very important factor amongst professional educational trainers and academics, though there is an argument about the lack of clarity and acceptance of this practice in real-life and how best it could be achieved (Gadsby & Cronin, 2012). In addition, there has been a remarkable shift in the understanding of what constitutes effective reflective practice in STEM subjects in particular. There have been spectacular reflective growth and benefits from other educational disciplines and institutions (Lockhart et al. 2017). In this 21st century, course components that needs mastering are taught with component of reflection in a face-to-face class setting, In this case, students are free to exchange ideas after reflection in order to contribute to the lecture.

This study describes how reflective practice could be improve among blended learning students in a science technology engineering and mathematics (STEM) disciplines and how important the need for classroom reflection before the class assessment in order to aid learning. The study result has shown how students are motivated to learn and the activities that mediated and encourage the students to be motivated to learn.

LITERATURE REVIEW

Reflection has been caption and widely used in most continuous professional development (CPD) setting across interdisciplinary subjects and trainings. Teaching is the core profession, the key agent of change in today's knowledge society (Hargreaves and Goodson, 1996). Teaching is not 'instrumental' and compartmentalise as how many people believe it to be (Sachs and Logan, 1990). The process for an educator to improve in the craft of teaching does not happen overnight or over a short time span. Instead, an educator's learning and acquiring effective teaching skills requires one to study his or her own experiences in the classroom and reflect to improve teaching and is mastered over time. Day (1999) suggest that the process of a teacher to learn and gain pedagogical knowledge and skills is based on accumulation of new acquired knowledge and teaching methods as well as strategies to be added to his or her repertoire of existing knowledge of the content and skills. Reflective practice covers more than just summarizing what happened in the classroom. According to Richards and Lockhart (2007), reflective practice 'refers to an activity or process in which an experience is recalled, considered, and evaluated, usually in relation to a broader purpose'. According to Finlay (2008), reflective practice is the process when educators are 'learning through and from experience towards gaining new insights of self and practice'. Reflection is also a basic component of teaching and learning and happens in a cycle which is repeated according to the following stages in each cycle.

• Teaching students
• Self-assess the effect of one's teaching and its impact on students learning
• Try to implement new ways of teaching which can improve the quality of students' learning
• Adopt these new cutting age ideas in practice
• Repeat the process again

There are many important methods of how reflective practice can be explored by STEM educators to improve teaching and learning (Heins-Wesson and Young 2017). Giroux (1987) explained that teachers become transformative individuals when they engage and empower their students to probe and discuss about contradictions of concepts in society. By including pair and group discussions during lessons in the classroom, educators are encouraging interaction among students as well as facilitating collaborative learning. By including such activities in lessons, educators can observe the learning that is taking place and indirectly obtain feedback from students' interaction and participation in the teaching and learning activities.

According to Brookfield and Preskill (1999), the potential of group talk in the classroom can be the result of blending discussion, dialogue and conversation. It is possible to make a distinction between each one however all three invites participants to speak in an unrehearsed intellectual adventure. The term discussion is to explore the practice and theory of group talk of students where they are blending and synthesizing the descriptions of dialogue, discussions and conversations (Doolan and Gilbert 2017, Brookfield and Preskill, 1999). The process of reflection by an educator after receiving feedback from students in such group tasks which includes interaction would assist the educator to evaluate the lesson and students' performance during various activities. Thus, the process of reflective practice supports the development of the educators' professional expertise based on their practice.

When educators use a reflective practice approach for their professional development, it is also crucial for them to consider the principles of andragogy by Knowles (1984) on how to teach adult learners. This is vital because undergraduate students at university already have previous knowledge and education in schools. Some of them also have work experience from internships, apprenticeships and part-time work. Knowles (1984) emphasised that there are a few assumptions about the characteristics of adult learners. They are one's self concept, adult learner experience, readiness to learn, orientation to learning and motivation to learn. Thus, the use of reflective practice by educators can monitor and review their teaching by using the following steps. Firstly, preparing lesson plans and lesson notes in advance of teaching. Secondly, preparing suitable task sheets and materials for students. Thirdly, reading through the lesson notes before the scheduled day of the lesson. The fourth step is for the educators to explore their teaching through reflective practice and self-enquiry. These steps would enable educators to familiarize themselves with the content and the teaching steps as well as prepare for reflection at various stages; before the lesson, during lesson and after completing the sessions with students.

By taking the initiatives of using reflective practice as an approach to improve one's teaching, it does not mean that one's teaching is not effective. Instead, it suggests that teaching experience alone is not sufficient for educators' professional development. Research suggests that a combination of teaching experience and reflective practice can be a powerful tool for continuing professional development.

RESULTS AND FINDINGS

Qualitative research approach was applied in this research for the data collection. This result section illustrates some questions from the questionnaire gathered during a blended classroom session. The data analysis was conducted using Statistical Package for the Social Science (SPSS) tool. The analysis was able to describe the various learning motivational approaches used in class and the students' reflection during their studies.

The following statements were selected to gather the thoughts of the blended-learning students' reflection as investigated in this research.

Q1: I found the teaching using seminars appropriate to enhance my self-study skills.

Figure 1 illustrates that over 70% of the students agreed that found the approaches used during the seminars to be useful and appropriate to enhance their learning skills.
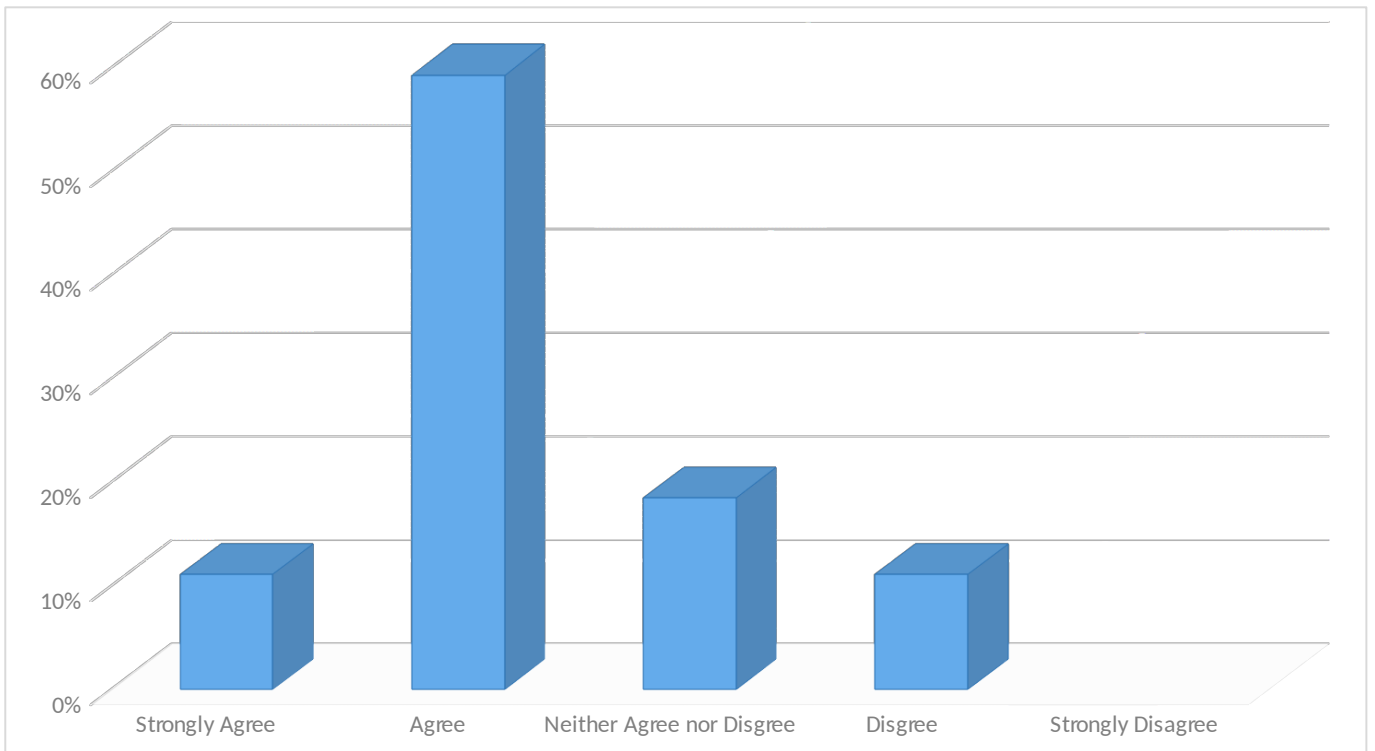
Figure 1. Illustrates how seminars enhance self-study skills

Q2: The blended classroom content was appropriate for my understanding

In response to the statement that the blended class content were appropriate for the students' learning experiences and understanding, Figure 2 demonstrates that over 92% of the students agreed that the content used during the blended classroom lectures were significant to their understanding and learning satisfaction.
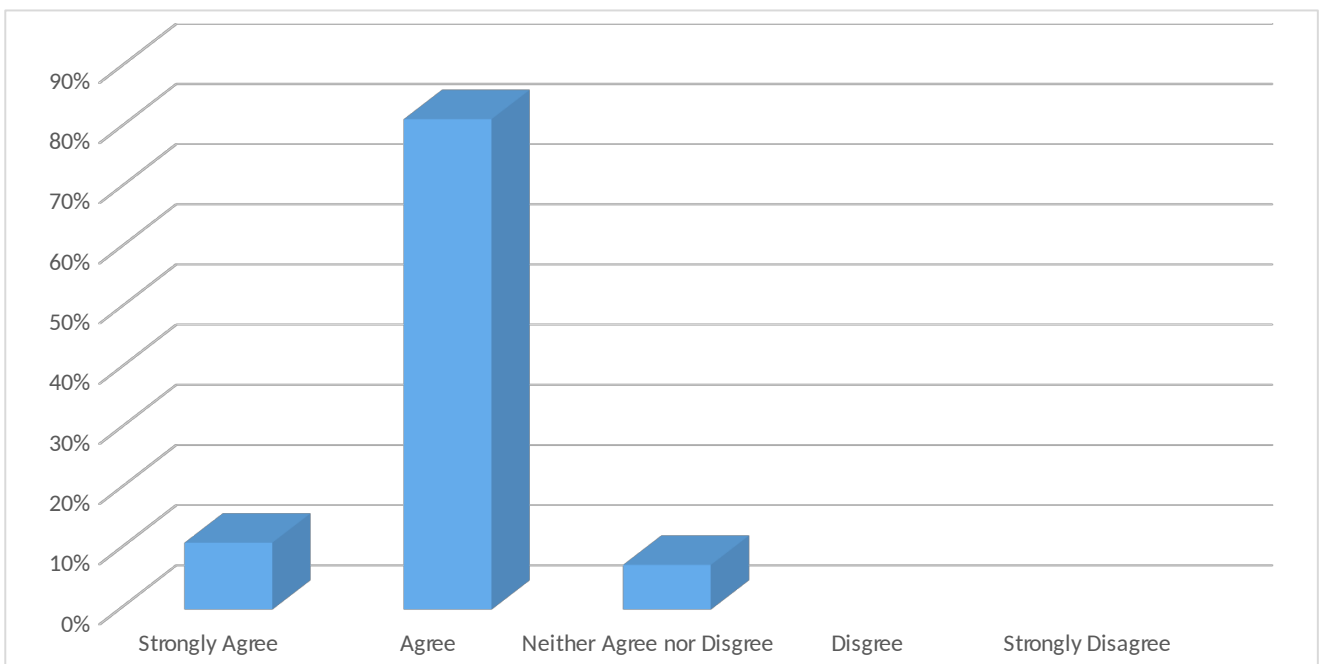

Figure 2. Shows how appropriate is the blended learning content to student understanding.

Q3: The interactive group learning exercise were beneficial to me

This reflective statement shows how the group exercises benefit the students in this study. The result demonstrates that over 55% of the students agreed to the statement that they interactive group exercises were helpful to them as shown in Figure 3.
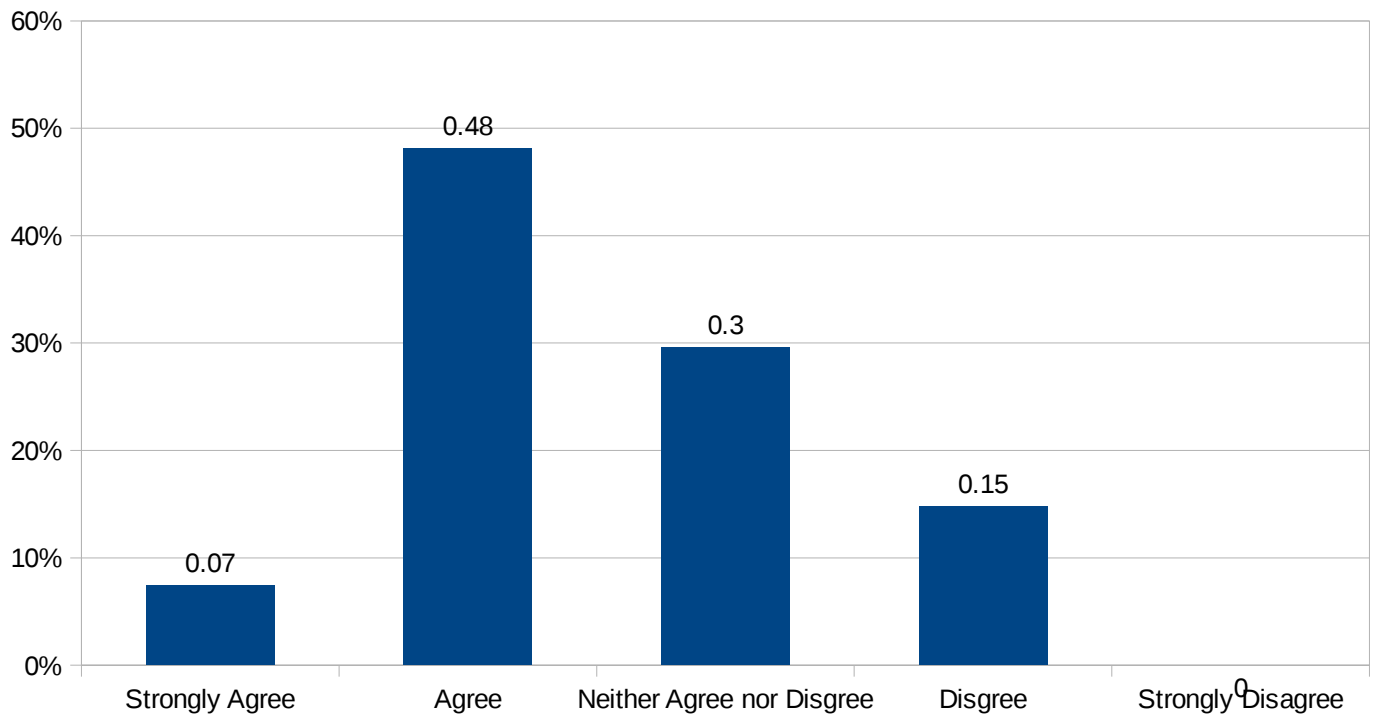

Figure 3. Demonstration of the benefit of interactive group learning.

Q4. I found the group discussions and presentations by group representatives very useful
Figure 4 reveals slightly over 48% of the respondents agreed to the statement that they found the group discussions and presentations were very useful in their studies and enhancing their learning experience.
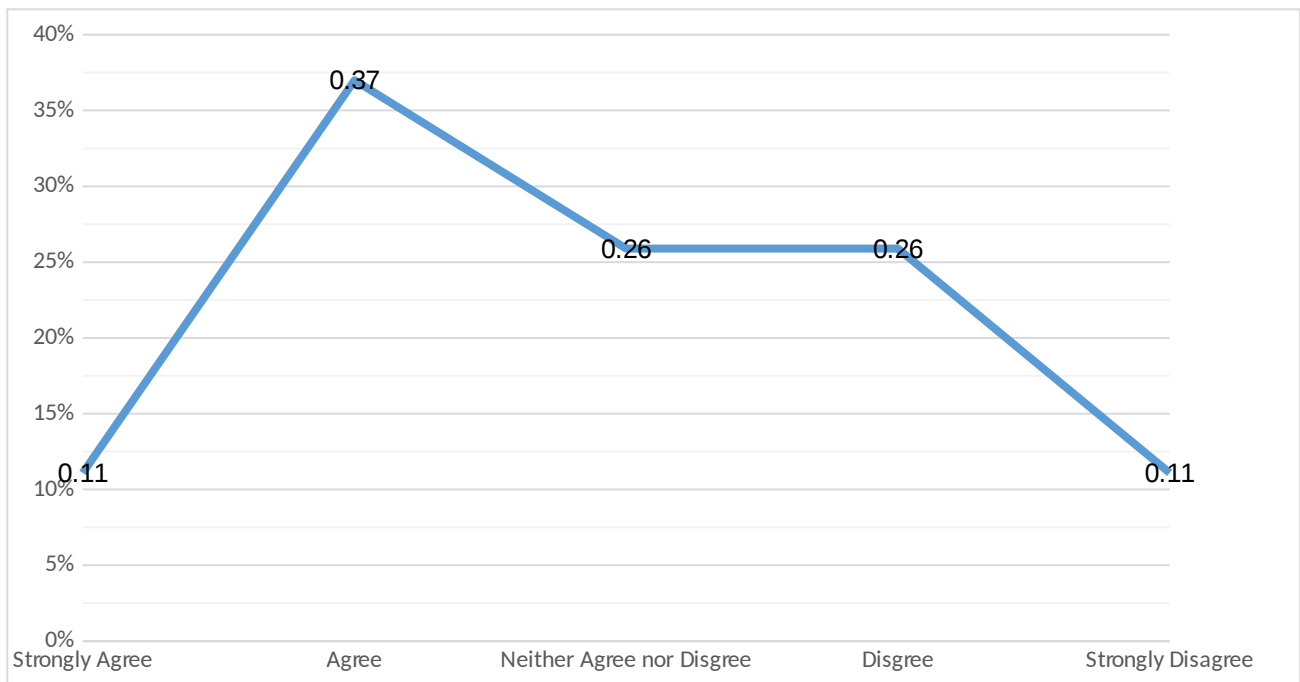
Figure 4. The significance of group discussions and presentation.

CONCLUSION

The study of computer science as a STEM subject combines content from science, technology, maths and engineering. The content from all four subjects are taught together and students used the components learned to solves complex problems and become globally competitive. Reflective practice in computer science and STEM subjects help the lecturers in their evaluation of students' learning. In addition, reflection is crucial for students' understanding of the content, making connections and becoming more aware of their learning, strengths and areas which need improvements.

Reflecting also helps the lecturers and students to plan, process and organize students' learning in innovative methods of teaching and learning. This includes the use of blended learning and incorporating interactive group activities in the classroom. Some example of these activities are seminars, tutorials with small groups of students, discussions, individual and group presentations. Collaborative work would motivate students to think critically and then do individual reflections and make connections to previous learning.

This study shows the level of high positive satisfaction and agreement received from the students with regards to how the blended classroom was conducted in an orthodox university certain was helpful to their academic achievement. Further investigation carried out in this study shows that a greater percentage of the students confidently accept the approaches applied during the classes. Most of the students agreed that these methods of teaching were appropriate to their needs and aspirations. The response to the questionnaires show how satisfied the students were with the seminar lectures.

This study has revealed the various ways students reflect on their studies and how the lesson content motivated them to study. Although there has been some criticism in the manner in which some students and academics reflect during and after lectures. This study illustrates that individual learners and professionals reflect on learning experiences in a distinctive manner suitable to their learning strength.

Reflective practice in STEM subjects has been improving nowadays with so many curricula involving aspect of teaching and reflection. Courses are taught with elements of assessment and reflection incorporated in the approach of delivery. The paradigms of teaching and delivering STEM subject should fully incorporate role-play that could involve students learning in group, reflecting and exchanging knowledge ideas (Trust and Horrocks, 2017).

ACKNOWLEDGMENT

REFERENCES

Brookfield, S. D. & Preskill, S. (1999) Discussion as a Way of Teaching. Great Britain: The Society for Research into Higher Education and Open University Press.

Cornford, I. R. (2002). Reflective teaching: Empirical research findings and some implications for teacher education. Journal of Vocational education and Training, 54(2), 219-236.

Day, C. (1999) Developing Teachers: The Challenges of Lifelong Learning. Great Britain: Falmer Press.

Doolan, M. A., & Gilbert, T. (2017). Student Choice: Blends of Technology Beyond the University to Support Social Interaction and Social Participation in Learning. In *E-Learning, E-Education, and Online Training: Third International Conference, eLEOT 2016, Dublin, Ireland, August 31– September 2, 2016, Revised Selected Papers* (pp. 95-102). Springer International Publishing.

Finlay, L. (2008) 'Reflecting on reflective practice', PBPL CETL, Open University, [Online] Available at http://www.open.ac.uk/opencetl/resources/pbpl-resources/finlay-l-2008-reflecting-reflective-practice-pbpl-paper-52, (Accessed 18 January 2018)

Fry, H., Ketteridge, S., and Marshall, S. (eds)(2009), A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice, London: Routledge.

Gadsby, H., & Cronin, S. (2012). To what extent can reflective journaling help beginning teachers develop Masters level writing skills?. Reflective Practice, 13(1), 1-12.

Gibbs, G. and Habeshaw, T. (1992). Preparig To Teach: An Introduction to Effective Teaching in Higher Education. 2 nd Edition. Bristol: Technical and Education Services.

Hains-Wesson, R., & Young, K. (2017). A collaborative autoethnography study to inform the teaching of reflective practice in STEM. *Higher Education Research & Development*, *36*(2), 297-310.

Hargreaves, A. and Goodson, I. (1996) Teachers Professional Lives: Aspirations and Actualities, in Goodson, I. and Hargreaves, A. (eds) Teachers' professional Lives, New York: Falmer Press.

Johnston, B., Ford, P., Mitchell, R., & Myles, F. (2011). Developing student criticality in higher education: Undergraduate learning in the arts and social sciences. Bloomsbury Publishing.

Kolb, D. (1984) Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs, NJ: Prentice-Hall.

Knowles, M. (1984). Andragogy in Action. San Francisco: Jossey-Bass.

Loughran, J. J. (2002). Effective reflective practice in search of meaning in learning about teaching. Journal of teacher education, 53(1), 33-43.

Marton, F and Booth, S (1997). Lerning and Awareness, Mahwah, NJ: Lawrence Erlbaum Associates.

Onah, D. F. O., & Sinclair, J. (2015). Learning as a perspective of reflective practice in computer science. Available at: http://wrap.warwick.ac.uk/75540/7/WRAP_55f47c3708ae6a34f6608ed5.pdf (Accessed 18 January 2018).

Ottesen, E. (2007). Reflection in teacher education. Reflective practice, 8(1), 31-46.

Parsons, M., & Stephenson, M. (2005). Developing reflective practice in student teachers: Collaboration and critical partnerships. Teachers and teaching, 11(1), 95-116.

Richards, J.C. and Lockhart, C. (2007): Reflective Teaching in Second Language Classrooms. Cambridge University Press.

Sachs, J. and Logan,L. (1990) Control or Development ? A Study of In-service Education. Journal of Curriculum Studies, Volume 22, Issue 5. Page 473-481.

Salter, S., Douglas, T., & Kember, D. (2017). Comparing face-to-face and asynchronous online communication as mechanisms for critical reflective dialogue. *Educational Action Research*, *25*(5), 790-805.

Trust, T., & Horrocks, B. (2017). 'I never feel alone in my classroom': teacher professional growth within a blended community of practice. *Professional Development in Education*, *43*(4), 645-665.

Lockhart, J., McKee, D., & Donnelly, D. (2017). Delivering Effective Blended Learning: Managing the Dichotomy of Humility and Hubris in Executive Education. *Decision Sciences Journal of Innovative Education*, *15*(1), 101-117.