

PROBLEM-BASED LEARNING: AN INSTRUCTION METHOD FOSTERING LEARNER AUTONOMY

© Natália BORZA

(Karinthy Frigyes Bilingual Academic Grammar School, Budapest,
Hungary)

nataliaborza@gmail.com

Received: 28.07.2012; Accepted: 26.11.2012; Published online: 05.06.2013

Learner autonomy is of vital importance in language teaching, particularly in reaching better outcomes in language acquisition, in integrating foreign language use, as well as in increasing motivation. How far learners become autonomous greatly depends on the method within whose framework they learn. The present study explores the extent to which a pedagogical approach supporting self-directed learning can be applied successfully in teaching English as a foreign language (EFL). The student-centred instruction method under investigation poses “contextualized, real-world situations” to learners in order for them to “develop content knowledge and problem skills”, and has become known as problem-based learning (PBL). Introducing the seven jump model by Schmidt (1983), the paper compares and contrasts PBL, which has not been widely used in foreign language teaching, and task-based language learning (TBLL), which is a well-researched and widely practiced language teaching method. Given that PBL originates from medical sciences, it is heavily researched in its mother field and other related sciences. Providing an overview of PBL in various academic environments through compiling the results of several meta-analyses, the study examines the effectiveness of PBL over the last four decades. Relying on the results of numerous empirical research projects conducted in several fields, the paper discusses the advantages and shortcomings of the method. Concerns that need special attention when implementing PBL are also addressed. Based on the experience and findings of educators and researchers of PBL in various academic fields, the study provides implications for EFL teachers willing to foster self-directed learning.

Keywords: Teaching English as a Foreign Language; Problem-Based Learning; Task-Based Language Learning

Learner autonomy has become a buzzword in language teaching (Barfield & Brown, 2007; Little, 1999, 2007; Palfreyman & Smith, 2003). Over the last two decades, research interest has increasingly turned to learner autonomy, namely, the learner’s ability to rule himself (Ryan & Powelson, 1991) and to take charge of his own learning (Holec, 1980). The underlying reason might be the fact that autonomous language learners tend to be more successful in

various areas of learning. First of all, an autonomous learner has better outcomes in language acquisition and consequently masters the foreign language to a greater extent (Deci et al., 1991; Little, 2009; Little, Ridley & Ushioda, 2003; Nakata, 2010; Ryan & Grolnick, 1986; Sao & Wu, 2007; Ushioda, 2010). Besides, autonomous learners manage to integrate the language use learnt in the classroom into their lives (Rogers, 1983; Ryan, & Grolnick, 1986). As a third advantage, autonomous learners are more volitional, more interested and motivated in learning a foreign language (Deci et al., 1991; Ryan, & Powelson, 1991). Additionally, learner autonomy is not confined to the classroom as it is highly likely to result in pursuing lifelong learning (Egel, 2009). Having the above beneficial effects on both the process and the product of language learning, learner autonomy deserves to be nurtured in teaching English as a foreign language (EFL). A potential method that might be used in order to foster autonomy in language learning is one that has been applied and researched for about four decades in the teaching of sciences, particularly in medical and health education courses. The growth in autonomy, or the self-directed quality in the process of acquiring knowledge, as it is referred to in the teaching of sciences (Savery & Duffy 1996; Torp & Sage 2002), can be assisted by creating a learning environment that poses problems to the learner. Problem-based learning has proved to be fruitful to some extent in the teaching of sciences; however, it has not been widely applied to foreign language teaching. This paper attempts to examine what EFL teachers can learn from the method already tested in the fields of sciences.

The present study aims at providing a pedagogically-driven literature review of problem-based learning, a self-directed learning method applied in the education of sciences. Consequently, the effectiveness of the method using “*a student-centred pedagogical strategy that poses significant, contextualized, real-world, ill-structured situations while providing resources, guidance, instruction, and opportunities for reflection to learners as they develop content knowledge and problem skills*” (Hoffman & Ritchie, 1997:97) is investigated. Respectively, the study focuses on the following research question: *Based on already existing research on problem-based learning (PBL), what strengths and weaknesses of the instruction method can be identified?* The findings obtained from this study will help draw implications for EFL teachers willing to foster learner autonomy by means of applying PBL in the classroom.

The origins of PBL go back to the 60s and 70s of Canada, where it was developed and implemented as a possible solution to medical students' poor clinical performance. *Harold Barrows*, professor at McMaster University Medical School, considered the way medical students were trained to be the root of the failure, since traditional lecture format did not provide students with knowledge applicable in real life medical practice (Barrows, 1996). As the four decade long history of PBL abounds in empirical research, great care had to be taken when selecting research papers for the present literature review. Striving to outline a balanced overview of the bulky material and to integrate the great number of findings, meta-analyses were chosen to be investigated. In other words, comprehensive analyses of several different empirical research conducted in a given period of time were analysed. Consequently, the present review is based on meta-analytical studies that meet the following criteria:

- the entirety of the meta-analyses examined cover all the four decades of the history of PBL;
- the number of statistical (quantitative) and narrative (qualitative) meta-analyses chosen is balanced;
- besides relying on the mother field of medical research, other educational fields are represented.

Accordingly, Table 1 shows in detail the seven meta-analytical research papers chosen as the basis of the present review.

Table 1. *The meta-analyses on which the present literature review is based*

Researchers	Journal	Published	Embraces	Nature
Albanese, M. A., & Mitchell, S.	Academic Medicine	1993	1972-1992	narrative
Berkson, L.	Academic Medicine	1993	pre-1992	narrative
Colliver, J. A.	Academic Medicine	2000	1992-1998	statistical
Dochy, F. et al.	Learning and Instructions	2003	43 studies	statistical
Gijbels, D. et al.	Review of Educational Research	2005	1976-2000	narrative
Vermon, D. T. A., & Blake, R. L.	Academic Medicine	1993	1970-1992	statistical
Yuan, H. B. et al.	Journal of Nursing Training	2008	1990-2006	statistical

The strengths and weaknesses of PBL stem from the nature of the instruction method itself. Barrows (1996) claims that PBL mirrors nature as to the process of acquisition, since learning is triggered by facing authentic problems. In contrast, artificial ways of learning, such as rote learning, do not pose real problems to the learner thus the student is not deeply engaged in the learning process. Secondly, PBL emphasises problems over content, that is, content is organized while a series of problems is being solved instead of the educator providing content prior to solving problems. Besides, reasoning is strengthened by PBL when students find cause and effect relationships, explain choices or find out which pieces of information are relevant to be considered when solving a given problem. Additionally, students have a strong chance of active participation since PBL is typically applied in small groups.

The steps of a PBL course or series of classes are minutely described by Schmidt (1983), who lists the seven important ingredients of PBL in his seven jump model. First, students in small groups are exposed to a problem stimulus by the teacher. In this phase students are to clarify concepts by asking questions and requesting more information from the tutor. Second, it is the students who identify the problem, phrase it, as well as, determine its domain of investigation. Thirdly, students start to analyse the problem based on their own prior knowledge. Then students formulate hypothesis about the problem, at the same time, the group acknowledges what knowledge they fail to possess. In the fifth step students formulate learning goals and objectives, that is, the group of students agrees on independent, self-directed study or research. The sixth step is carried out between two sessions, this is the phase when students collect additional information and meet their learning goals. In the last step students discuss and synthesise their findings with the facilitation of the tutor. In a foreign language learning environment, however, one more step should be added to *Schmidt's seven jump model* (1983). Namely, presentation as a final move in PBL courses shall not be

ignored. Presentation might involve all the previous seven steps, as it is not simply the solution that is in the limelight. On the contrary, the process of solving a problem, discussing various options and coming to agreements are also important steps through which students benefit and learn. This additional eighth step gives students a chance to summarize their learning process to other small groups in the class, as well as to use the foreign language needed to solve the problem productively.

Due to the problem-focused nature of the instruction method, PBL might seem to be identical with task-based language learning (TBLL) for EFL teachers. The two approaches, however, are genuinely different. Most importantly, PBL exploits real life problems where answers are needed to be sought; however, the problems in TBLL are not real in the sense that the teacher is familiar with the possible answers right at the outset of the problem. Likewise, the domain of the problem is more flexible in PBL, where students themselves identify the problem and its scope. In contrast, the problem domain in TBLL is strictly determined by the teacher or the course book. Finally, the purpose of PBL is to solve a problem, whereas the aim of TBLL is to present certain language items and make students practise and finally learn them.

The seven meta-analyses narrating and analyzing the results and shortcomings of PBL report that the method is effective in increasing knowledge. Numerous studies express that PBL prepares students for passing standardized tests with higher scores than lecture students (Albanese & Mitchell, 1993; Arthur, 2001; Gallagher & Stepien, 1996; Hwang & Kim., 2006; Lieux, 2001; Michel et al., 2002; Rideout et al., 2002; Tiwari et al., 2006; Schlundt et al., 1999; Vermon & Blake, 1993). Moreover, PBL students do not only demonstrate a higher level of knowledge in the test year when they are exposed to the student-centred instruction method; however, longitudinal studies assert that PBL students manage to score higher than non-PBL students for at least two years (Tiwari et al., 2006).

Besides, the meta-analyses summarise other beneficial results of the method. Positive learning outcomes of PBL include enhancing students' problem solving skills (Barrows, 1996; Cook & Moyle, 2002; Dods, 1997; Dolmans & Schmidt, 1994; Kamin et al., 2001; Schmidt et al., 1992). Given that students are exposed to problems under the guidance of a tutor instead of being provided with lists of factual information in a lecture, students practise and acquire the ways of tackling problems effectively in small groups, which results in better problem solving skills.

Furthermore, the meta-analyses infer PBL to have a positive effect on critical thinking. In the studies PBL students are assessed to demonstrate greater improvement in critical thinking than lecture students (Cook & Moyle, 2002; Day & Williams, 2002; Morales-Mann & Kaitell, 2001; Tiwari et al., 2006; White et al., 1999; Yuan & Qian, 2003). The guidance and assistance of the PBL tutor as well as the discussions within the group of students admittedly cause students to think logical relationships and argumentations over, which might be responsible for developing critical thinking skills (Barrows, 1996).

Enumerating further beneficial effects of PBL, the instruction method is described to promote students' active participation in the learning process (Cook & Moyle, 2002). From the very beginning of PBL courses, students are clearly made responsible for what they learn. It is not the tutor but the group of students who identify and phrase the problem, who examine their own prior knowledge, who set learning objectives, who attempt to organise various pieces of information, who argue for possible solutions, finally, who give an account of their findings. Working within the framework of such an

instruction method does not let students fall into the passivity of listening to a lecturer.

Subsequently, a further merit of PBL lies in its effect on communication according to the meta-analyses investigated. The method is reported to affect students' communication positively by means of improving communication skills (Morales-Mann & Kaitell, 2001; Rideout et al., 2002; White et al., 1999). PBL creates a natural environment for team work, where communication is essential for the students. Students need to phrase the problem, to choose relevant pieces of information and to find the way of solving the problem. All of these steps are carried out in small groups; students are encouraged to share their knowledge and insights with their team members. As a consequence, students cannot do without practicing and thus improving their communicative competence. Given that arguing for or against possible ways of solving a problem is an indispensable element of PBL, students can not avoid presenting their opinion, which naturally leads to discussions in the group. Hence improving students' communication skills is constantly in the foreground.

Tightly connected with the previous merit of the method, PBL also has the advantage of enhancing students' cooperation in group work (Yuan & Qian, 2003). Identifying and solving the proposed problem is the task of the group, where each and every student has their own responsibility and own learning goal. That is, no student is expected to go through the process of solving the problem individually; however, students are to intertwine what they know and have discovered.

Besides the above positive cognitive and social effects of the instruction method, PBL is described in the meta-analyses as having beneficial affective or emotional effects as well. Namely, the teaching method is reported to increase students' satisfaction with the learning process resulting in a higher level of enjoyment by students and tutors alike; and likewise, it is also characterised by greater motivation (Hwang & Kim 2006; Michel et al., 2002; Rideout et al., 2002; Rogal & Snider, 2008; White et al., 1999).

To continue the list of strengths of PBL, its merits are not confined to the length of the PBL course; however, it is reported to have long-term positive effects as well. Particularly, PBL students seem to develop responsibility for their learning; consequently, they tend to pursue lifelong learning (Michel et al., 2002).

Despite the fact that PBL has numerous benefits, it is not a method without drawbacks. As described in the studies, one of the shortcomings of the instruction method is its costly nature (Farnsworth, 1994). The higher cost of the teaching method might not necessarily be reflected in financial terms, a traditional lecturer might earn as much as a PBL tutor. However, guiding small groups and providing individual help to students definitely requires a PBL tutor to devote more time on running the course smoothly. In a similar manner, students also need to spend more time on preparation in order to obtain similar learning outcomes as students working with traditional methods.

A further drawback of the method discussed in the meta-analyses concerns students' emotions. PBL is considered to cause a sense of discomfort at the initial stage of its implementation (Dabbagh et al., 2000; Hoffman & Ritchie, 1997; Jost et al., 1997; Schultz-Ross & Kline, 1999). The reason for such a discomfort is reported to be some students' unwillingness to take an active role in goal setting. This might be an obvious result of having trained students with feeding-and-regurgitating methods thus failing to familiarise them with taking responsibility for their own studies. Besides, low-achievers are found to get easily frustrated by not

being able to grab the essential content of a PBL course. Despite these initial difficulties, studies account that most PBL students develop positive attitudes towards the method by the end of their courses.

Weighing up the numerous strengths and handful of weaknesses of the method described in the meta-analyses, PBL can be claimed to enhance learner autonomy through developing self-directed learning, as well as improving problem-solving skills, developing critical thinking skills, promoting active participation in the learning process, developing communication skills, encouraging cooperation in group work, providing greater enjoyment and motivation, and promoting lifelong learning. Although PBL is proven to be time-consuming and can easily stir low-graders, especially at the initial stage, the studies collect evidence that the method increases students' factual knowledge.

The strengths and weaknesses of the instruction method can draw EFL teachers' attention to several points worth consideration when applying PBL in English teaching. First of all, students should be made aware of their own role in the language learning process. Setting a problem to students without having initiated them to the main idea of the instruction method can easily result in an ill-functioning course with students losing motivation. In other words, it is vital to discuss with the students what PBL is about prior to exposing them to a new teaching method. Once they have understood their own roles in the learning process, they tend to be more cooperative.

Similarly, it should be made clear to the students that the new method might be stirringly strange for them at the beginning. Such an explanation has the advantage of reducing initial discomfort; students will feel that support is given to them in the adjustment period. When students are aware of the fact that it is only normal to have mixed feelings in the transition period, they will not easily get entangled in their negative emotions. That is, developing a positive attitude towards the teaching method is made easier this way.

In the case of applying PBL in the teaching of medical or other sciences, it can be taken for granted that the professional problems posed to the students are relevant to the learners' further needs since all the students are in the same pre-service education. It is not the case, however, with EFL students, who come from various professional backgrounds. As a result, in an EFL group careful needs analysis should be carried out before exposing students to problems. Small groups should be formed in such a way that their members share some common interest, which provides a common ground for real-life problems for them. On the contrary, if members of the small groups have nothing in common, the problem they are to solve will not trigger genuine interest, the students will not find the problem a real-life one. Consequently, they will not have a genuine drive to go through the stages of solving the problem, which can easily result in losing their motivation as well as putting considerably less effort into the learning process.

Provided that some common interest is found among the group members in which field a real-life problem can be posed to them, minute attention should be also paid to the complexity of the problem. For language teachers familiar with task-based language teaching it is vital to bear in mind that PBL uses problems where real answers are sought. Namely, neither the teacher nor the course book has the answer at the outset of the task. Finding the scope of the problem, sorting out relevant information, searching for new pieces of information, sharing knowledge and discussing arguments are impossible for the students to carry out if the problem is simple enough to see the answer right at the beginning, if the solution is provided by the course book. Since it is the problem that lies at the heart of PBL, it should be

made certain that the tasks are neither too easy or straightforward nor too complicated. Once the students find a task too complex to tackle, the guidance of the PBL tutor involves helping students sort out and organise relevant pieces of information.

Considering the design of the problem, PBL tutors shall make sure that students assign a realistic range to the problem. Too broad problems require far too much research, which might turn out to be unmanageable for the students; while a limited scope does not give space for investigation or contrasting ideas. It is also the PBL instructor's responsibility to facilitate group work with the help of checking if there is a fair share of tasks among the group members. Besides, it is also vital to see whether the individual learning goals are appropriate.

A salient point for EFL teachers is to set problems which require the students to collect information in the target language. As PBL is applied to foster learner autonomy, the problem to be solved should be researched in English, not in the mother tongue; otherwise students will fail to work with authentic materials. To ensure that students treat authenticity as important, they can be required to list the websites and other sources they used while gathering information and finding their solution.

In an EFL teaching context Schmidt's seven jump model (1983) shall be completed with an additional eighth step, namely, that of presentation. Once students have found an answer to the problem, it is important to give an account of both the solution and the process of getting there. Such an overview gives the EFL learners a second chance to produce meaningful texts with real-life content based on researching authentic materials. This way the foreign language input gained through receptive skills (typically reading or in some cases listening) is reinforced through the use of productive skills (speaking or writing). Presenting the problem, the way of sorting it out and the solution itself can be delivered both in an oral or a written form to other small groups in the class or school. Besides giving a PowerPoint presentation, students can write reports or compile portfolios as well to share their findings.

Unlike in the teaching of sciences, there is a limitation to this instruction method in the frame of foreign language teaching. It shall be noted that PBL cannot be applied at all levels of EFL teaching. Since the method involves discussions and individual research, learners of the foreign language should have a moderate command of the target language, particularly students should be at a pre-intermediate level or above. Complete or false beginner students will not find the way to collect information or argue for their opinion in the target language.

References

- ALBANESE, M. A., & MITCHELL, S. (1993). Problem-based learning. A review of literature on its outcomes and implementations issues. *Academic Medicine*, 68 (1), 52-81.
- ARTHUR, D. (2001). The effects of the problem-based alcohol early-intervention education package on the knowledge and attitudes of students of nursing. *Journal of Nursing Education*, 40 (2), 63-72.
- BARFIELD, A., & BROWN, S. (2007). *Restructuring autonomy in language education*. Basinstoke: Palgrave.
- BARROWS, H. S. (1996). Problem-based learning in medicine and beyond: a brief overview. In Wilkerson, L., & Gijsselaers, W. H. (Eds.), *New directions for teaching and learning* (pp. 3-11). San Francisco: Jossey-Bass Publishers.
- BERKSON, L. (1993). Problem-based learning: Have the expectation been met? *Academic Medicine*, 68 (Supplementary), S79-S88.

- COLLIVER, J. A. (2000). Effectiveness of problem-based learning curricula. *Academic Medicine*, 75 (3), 259-266.
- COOK, M., & MOYLE, K. (2002). Students' evaluation of problem-based learning. *Nurse Education Today*, 22 (4), 330-339.
- DABBAGH, N. H., JONASSEN, D. H., YUEH, H. P., & SAMOUILOVA, M. (2000). Assessing a problem-based learning approach to an introductory instructional design course. A case study. *Performance Improvement Quarterly*, 13 (3), 60-83.
- DAY, R. A., & WILLIAMS, B. A. (2002). Development of critical thinking through problem-based learning. A pilot study. *Journal on Excelling in College Teaching*, 11, 203-226.
- DECI, E. L., VALLERAND, R. J., PELLETIER, L. G., & RYAN, R. M. (1991). Motivation and education. The self-determination perspective. *Educational Psychologist*, 26 (3), 325-346.
- DOCHY, F., SEGERS, M., BOSSCHE, P., & GIBBELS, D. (2003). Effects of problem-based learning. *Learning and Instruction*, 13, 533-568.
- DODS, R. F. (1997). An action research study of the effectiveness of problem-based learning in promoting the acquisition and retention of knowledge. *Journal for the Education of the Gifted*, 20 (4), 423-437.
- DOLMANS, D. H. J. M., & SCHMIDT, H. G. (1994). What drives the students in problem-based learning? *Medical Education*, 28, 372-380.
- EGEL, I. P. (2009). Learner autonomy in the language classroom: from teacher dependency to learner independency. *Procedia Social and Behavioral Sciences*, 1 (1), 2023-2026.
- FARNSWORTH, C. (1994). Using computer simulations in problem-based learning. In Orey, M. (Ed.), *Proceedings of the 35th ADCIS Conference* (pp. 137-140). Nashville: Omni Press.
- GALLAGHER, S. A., & STEPIEN, W. J. (1996). Content acquisition in problem-based learning: Depth versus breadth in American studies. *Journal for the Education of the Gifted*, 19 (3), 257-275.
- GIBBELS, D., DOCH, F., BOSSCHE, P., & SEGERS, M. (2005). Effects of problem-based learning. *Review of Educational Research*, 75 (1), 27-61.
- HOFFMAN, B., & RITCHIE, D. (1997). Using multimedia to overcome the problems with problem-based learning. *Instructional Sciences*, 25 (2), 97-115.
- HOLEC, H. (1980). *Autonomy and foreign language learning*. Strasbourg: Council for Cultural Co-operation of the Council of Europe.
- HWANG, S. Y., & KIM, M. J. (2006). A comparison of problem-based learning and lecture-based learning in the adult health nursing course. *Nurse Education Today*, 26 (4), 315-321.
- JOST, K. L., HARVAR, B. C., & SMITH, A. J. (1997). *A study of problem-based learning in a graduate education classroom*. Paper presented at the 19th Proceedings of selected research and development presentation at the national convention of the association for educational communications and technology. Albuquerque, NM.
- KAMIN, C. S., O'SULLIVAN, P. S., YOUNGER M., & DETERDIGN, R. (2001). Measuring critical thinking in problem-based learning discourse. *Teaching and Learning in Medicine*, 13 (1), 27-35.
- LIEUX, E. M. (2001). A skeptics's look at PBL. In Duch, B., Groh, S. E., & Allen, D. E. (Eds.), *The power of problem-based learning: A practical ,how to' for teaching undergraduate courses in any discipline* (pp. 223-235). Sterling, VA: Stylus Publishing.
- LITTLE, D. (1999). Learner autonomy is more than a Western cultural construct. In Cotterall, S., & Crabbe, D. (Eds.), *Learner autonomy in language learning: Defining the field and effecting change* (pp. 11-18). Frankfurt: Peter Lang.
- LITTLE, D. (2007). Language learner autonomy: Some fundamental considerations revisited. *Innovation in Language Learning and Teaching*, 1 (1), 14-29.
- LITTLE, D. (2009). Learner autonomy in action: Adult immigrants learning English in Ireland. In Kjisik, F., Voller, P., Aoki, N., & Nakata, Y. (Eds.), *Mapping the terrain of learner autonomy: Learning environments, learning communities and identities* (pp. 50-85). Tampere, Finland: Tampere University Press.
- LITTLE, D., RIDLEY, J., & USHIODA, E. (2003). *Towards greater learner autonomy in the foreign language classroom*. Dublin: Authentik.

- MICHEL, M. C., BISCHOFF, A., & JAKOBS, K. H. (2002). Comparison of problem- and lecture-based pharmacology teaching. *Trends in Pharmacological Sciences*, 23 (4), 168-170.
- MORALES-MANN, E., & KAITELL, C. A. (2001). Problem-based learning in a new Canadian curriculum. *Journal of Advanced Nursing*, 33 (1), 13-19.
- NAKATA, Y. (2010). Towards a framework for self-regulated language-learning. *TESL Canada Journal*, 27 (2), 1-10.
- PALFREYMAN, D., & SMITH, R. C. (2003). *Learner autonomy across cultures: Language education perspective*. Basingstoke: Macmillan.
- RIDEOUT, E., ENGLAND, V., BROWN, B., FORTHERGILL, F., INGRAM, C., BENSON, G., ROSS, M., & COATES, A. (2002). A comparison of problem-based and conventional curricula in nursing education. *Advanced Health Science Education*, 7 (1), 3-17.
- ROGAL, S. M. M., & SNIDER, P. D. (2008). Rethinking the lecture: The application of problem-based learning methods to atypical contexts. *Nurse Education in Practice*, 8 (3), 213-219.
- ROGERS, C. (1983). *Freedom to learn*. New York: Merrill.
- RYAN, R. M., & GROLNICK, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology*, 50 (3), 550-558.
- RYAN, R. M., & POWELSON, C. L. (1991). Autonomy and relatedness as fundamental to motivation and education. *Journal of Experimental Education*, 60 (1), 49-66.
- SAO, H., & WU, Z. (2007). Nurturing language learner autonomy through caring pedagogic practice. In Barfield, A., & Brown, S. (Eds.), *Restructuring autonomy in language education: Inquiry and innovation*. Basingstoke: Palgrave.
- SAVERY, J. R., & DUFFY, T. M. (1996). Problem-based learning: An instructional model and its constructive framework. In Wilson, B. G. (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 135-148). Englewood Cliffs, NJ: Educational Technology Publications.
- SCHLUNDT, D. G., FLANNERY, M. E., DAVIS, D. L., KINZER, C. K., & PICHERT, J. W. (1999). Evaluation of a multicomponent, behaviorally oriented, problem-based summer school program for adolescents with diabetes. *Behavior Modification*, 23 (1), 79-105.
- SCHMIDT, H. G. (1983). Problem-based learning: rationale and description. *Medical Education*, 17 (1), 11-16.
- SCHMIDT, H. G., BOSCHUIZEN, H. P. A., & VRIES, M. (1992). Comparing problem-based with conventional education: A review of the University of Limburg medical school experiment. *Annals of Community-Oriented Education*, 5, 193-198.
- SCHULTZ-ROSS, R. A., & KLINE, A. E. (1999). Using problem-based learning to teach forensic psychiatry. *Academic Psychiatry*, 23 (1), 37-41.
- TIWARI, A., LAI, P., SO, M., & YEUN, K. (2006). A comparison of the effects of problem-based learning on the development of students' critical thinking. *Medical Education*, 40 (6), 547-554.
- TORP, L., & SAGE, S. (2002). *Problems as possibilities: Problem-based learning for K-16 education*. Alexandria, VA: Association for Supervision and Curriculum Development.
- USHIODA, E. (2010). Researching growth in autonomy through I-statement analysis. In O'Rourke, B., & Carson, L. (Eds.), *Language learner autonomy: Policy, curriculum, classroom* (pp. 45-62). Oxford: Peter Lang.
- VERMON, D. T. A., & BLAKE, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine*, 68 (7), 550-563.
- WHITE, M. J., AMOS, E., & KOUZEKANINI, K. (1999). Problem-based learning. An outcomes study. *Nurse Educator*, 24 (2), 33-36.
- YUAN, H. B., & QIAN, X. L. (2003). Application of problem-based teaching method in nursing. *Journal of Nursing Training*, 18, 148-150.