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# Editorial board

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# All the Problems in the World Either Begin in Families or End Up in Families

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Editorial

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Since the title of this editorial is the first two Big Ideas that are going to be discussed here, let me say it once more, with emphasis: *All the problems in the world either begin in families or end up in families*.

That's not my idea. That's from a long-time and dear friend, Dr. David H. Olson, professor emeritus of family studies at the University of Minnesota – St. Paul, USA.

What David is implying is that sometimes the roots of a problem in life can be traced back to the family, because families can be really good at making problems for themselves: alcohol and other drug problems; physical, emotional, and sexual abuse; extramarital affairs; an inability to manage financial resources effectively; poor communication skills and endless conflict among family members; gender discrimination and an imbalance of power; on and on and on. Make your own list, if you would like. It is easy to do.

What David is also saying is that there are many other problems that families are forced to face that are not of their own making: war; famine; racism, ethnocentrism, tribalism, hatred; overpopulation and subsequent environmental degradation; economic collapse; hurricanes, volcanic eruptions, tsunamis; global warming and the destruction of ecosystems; waves of coronavirus variants crashing into families from every direction; on and on and on. You can make your own list of these problems that begin outside the family, also. Your list will be as good as mine.

Now stay with me here: What David H. Olson is also implying is that whether or not a family causes the problem or the problem is imposed upon the family by the world around them, the family, in the final analysis, ends up stuck with the problem. The family ends up dealing with it. Think of the pandemic: We have been attacked by miniscule viruses – so small that if you were able to line them up in a row, 2,500 of them would *fit between the end of this sentence*. And the beginning of this next sentence. Go back two sentences to the period on the last sentence (.) and then move your eyes right to the capital ("A") of the very next sentence and think about that. So small that 2,500 individual viruses if lined up fit in the tiny space between the two sentences. It seems surreal, doesn't it, that something that small but in vast, incomprehensible numbers could kill and physically and emotionally damage billions of people around the world and bring human civilizations to a halt. And, this little virus cannot think and scientists don't even know for sure whether it is "alive" or "not alive". It is an accident of billions and billions of years of evolution and mutation. Is this a bad disaster movie everyone in the world is living in? Could Hollywood or Bollywood have dreamed this madness up?

So, we are attacked from all directions and every institution in the world and every individual is affected in countless negative ways: our health care systems; our businesses; our social welfare systems; our educational institutions; our religious organizations. Terrible negative effects of which we are all well aware. You know what I'm talking about.

But in the final analysis, in countless ways, the problem has not begun in the family, but the problem ends up in the family: When you go home at night, you go to your home where, most

likely, you live in some kind of family – we all live in a family, one family among literally billions of families in the world and these families are so remarkably and beautifully diverse we will never ever be able to even describe a tiny fragment of this diversity adequately.

All these wonderfully (and sometimes disturbingly) diverse families are forced whether they like it or not to deal with the global pandemic. I could make a stab at describing this, but it would take thousands of pages and I would, in the end, fail in my task. Better yet: Just think about how the pandemic has affected your beautiful (and sometimes curious or disheartening) little family. You're stuck with the pandemic, aren't you? Right up to your neck.

That brings me to the next *Big Idea* in this brief editorial: *When you're thinking about a family, look for their strengths*. Don't waste a lot of time focusing on what's wrong with the family. That gets you nowhere. Focus on the qualities that make the family work well.

Now, of course, not all families are strong families. But all families have strengths. So, look for the strengths of your own family, and the strengths of the families you are working with. All families in the world face innumerable challenges in life. That's a given. No one gets out of life alive. But if we spend all our time thinking about what's wrong with a family, we get nowhere. Look for the strengths, because families use their strengths to meet life's inevitable challenges and disasters.

And what are these strengths? Since the mid-1970s, I've been working with a team of a couple hundred researchers, clinicians, family educators and counselors, and community-oriented specialists around the world to better understand strong families and family strengths. We look at families who believe they have significant family strengths to deal with life's challenges; who love each other, who care for each other, who are satisfied with their family relationships. We have studied how families use their strengths to meet life's challenges in 39 countries of the world. Sound and diverse studies have been done in Australia, Austria, China, Fiji, Germany, Hong Kong, India, Indonesia, Jordan, Kenya, Korea, Malaysia, Mexico, Qatar, Russia, South America, Switzerland, Tunisia, USA, and other countries. Literally in all the seven major geocultural areas of the world: Africa, Asia, Europe, Middle East, North America, and Oceania.

Each country and each culture and, literally, each family has a different constellation of family strengths and use these strengths in different ways and in different contexts. We are all unique. But, paradoxically, we are also all so very similar. Our research team has created a useful general model to give you an idea, broadly speaking, of the major strengths of families around the world. We call this the International Family Strengths Model. There are six critical family strengths in the model, with 85 sub-categories, that we have seen in every culture we have studied, from contemporary urban cultures to traditional rural cultures: 1.) appreciation and affection for each other; 2) commitment to the family; 3) positive communication in the family; 4) enjoyable time together; 5) the ability to manage stress and crisis effectively; and 6) a sense of spiritual well-being and shared values.

So, when you are working with families in your career, or thinking about your own family, remember two things: 1) in the final analysis, the misery of the world falls upon the shoulders of families and, thus, families need to be valued and better understood; and, 2) the solutions to these problems can be traced back to the strengths of these families, and the support these families receive from strong communities and good and dedicated professionals. Like you.

Many professionals provide services that involve or respond to the needs of the family. Therefore, in contemporary education and practice, learning events need to cause students to focus on the nature and extent of contributions that families can make. In recent times many services have been 'outsourced' to family members who may or may not be fully prepared for the level of responsibility that is expected. Working with families, professionals can add value to their approach to the provision of care or services. This is clear for example in the case of health professionals, educators, lawyers, architects.

To highlight the 'strengths of families' implies that real partnerships with them can lead to optimal outcomes. Learning events that focus on family involvement in various situations are thus worthy of inclusion in a range of program offerings.

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## CONFLICT OF INTEREST

The author declared no conflict of interest.

# The Mantra of Architecture Practitioners: Architectural Education is Detached From the Profession. Healing the Schism: The Need for Reformation in UK Architecture Education

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The schism that exists between UK architecture academics and architecture practitioners is now a significant issue because the practical-knowledge gap within the profession has diminished the status of the architect as an important member of the construction team. This opinion article explores the need for tutor training in architecture education. This article draws on findings from an investigation of teacher training and staff development in Higher Education to show that the ARB, RIBA and UK Schools of Architecture could begin to develop a professional teaching and CPD framework to support architect-tutors as a way of bridging the divide between academia and practice. This article argues that if educators and practitioners can work together more harmoniously, the UK architecture profession stands a better chance of meeting a challenging and unpredictable future.

**Keywords:** United Kingdom Architecture Education; Practical-Knowledge Gap; Tutor Training; Staff Development; Higher Education Reform; Frameworks for Education and Practice

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## INTRODUCTION

"Excellent histories of the architectural profession have been written (Crinson & Lubbock, 1994; Kaye, 1960; Saint, 1983). In each, reference is made to an apparent schism between architectural education and architectural practice" (Farren, 2000).

This historical context has led to a consistently unbridgeable gap being formed between architectural education (AE) and architecture practice. Farren, 2000 goes on to suggest that the current form of architectural education in the United Kingdom is relatively new. "Prior to the Oxford Conference of 1958 the profession had been the product of a predominantly office-based education process, enhanced (or for some disturbed) by an examination system and a variety of educational opportunities to support candidates" (Farren, 2000). As Roaf & Bairstow (2008) suggest, "The 1958 Conference was organized by Sir Leslie Martin on behalf of the Education Committee of the RIBA [Royal Institute of British Architects]. In 1958 the organizing committee had several objectives: 1) The Conference should draw together as much relevant factual information as possible 2) The discussion should bring out as much informed opinion as possible from people interested in widely different aspects of Architectural Education 3) The discussion should be frank 4) If possible, some line of action should emerge".

An illustration entitled 'Four Hundred Years of Architectural Education: Relative routes to qualification as an architect through time' (McCormack, 2020) substantiates Farren Bradley's comments. The yellow portion of this diagram, which references the proportion of architects who have chosen to qualify through the Higher Education (HE) route over time, is a relatively small proportion of the overall histomap. It was not until the 1970s that registered architects entered the profession via a combination of undergraduate and postgraduate education and a period of supervised training in practice (Farren, 2000). The two divergent views of the different factions can be summarised as follows:

**The Practitioner View**

Practicing architect Patrik Schumacher states his view succinctly, "…architectural education is detached from the profession and from societal realities…" (Ravenscroft, 2020). Griffiths (2020) summarises this view by stating, "…a large section of the profession thinks that educators are failing at our sole task: to train students for practice."

**The Academic View**

"Recently, a university seeking a new dean for its college of architecture asked me to review its advertisement for the position. I suggested revising 'seeking an educator who can perform the following' to 'seeking a professional with both educational and practical experience in his/her field of expertise who can perform the following'. 'Please, not a professional!' The faculty member's response implied that a professional was a practitioner. The further implication was that an educator is not a professional" (Steidl, 2009).

Where the Royal Institute of British Architects (RIBA) states that all Members of the profession must follow a prescribed academic curriculum and undertake ongoing Continuing Professional Development (RIBA Fulfilling your CPD requirements and obligations as a RIBA Member, 2020), no such methods of training or Continuing Professional Development (CPD) currently exist specifically to support architect-educators in the UK. However, Milliner (2000) suggests that the RIBA is the powerful lever in the profession; "It exerts a wide influence over architectural education, working alongside other key stakeholders to influence the way in which architecture is taught, practised and experienced in the studio, lecture theatre and drawing office". The need for teacher training in AE has been highlighted by many authors (see for example Teymur, 1992;Weaver, 1997; Nicol & Pilling, 2000; Weaver et al., 2000; Roaf & Bairstow, 2008). As will be shown in this article, the development of programmes to train architect-teachers how to teach have rarely been implemented in UK AE (Weaver, 1997;Weaver et al., 2000).

This article will argue that the agitation that has existed for nearly a century between academics and practitioners in UK AE could be eased by providing proper training and CPD for new and existing architect-educators. Schools of architecture in the UK could develop a professional teaching and CPD framework to support architect-teachers as a way of bridging the divide between academy and practice. This paper will conclude by suggesting that if educators and practitioners can work together more harmoniously, the architecture profession stands a better chance of meeting a challenging and unpredictable future.

## METHODS

In this part of the article, it is important to briefly explain to the reader the various methods used for teaching architecture to students in HE which are a form of Problem-based Learning (PBL). These descriptions will provide the necessary context to better understand how students learn but also how tutors teach in AE.

Currently, the RIBA has programmes at almost 60 schools of architecture and other course providers in the UK and typically, at least 50% of these courses are design project-based with the remaining 50% of the courses taught through traditional lectures. In this way architect-educators are asking students to become independent learners in the design studio while absorbing codified knowledge during their lectures.

Lectures in schools of architecture can take place synchronously on-line or in-person or asynchronously through videos and lectures and can be taught to entire cohorts or to small groups of students. Lectures in AE are sometimes termed 'seminars' and sometimes called 'workshops'; this terminology indicates to the participating students whether there will be substantial interactive elements built into the sessions.

In contrast, academic-educators believe that teaching design in the studio is "central and special" (Potts, 2000). Design studio is taught using a form of PBL and has many names in AE, including, but not limited to, the 'live' project, atelier, unit system, design charrette, design workshop and design competition. Where the assessment of knowledge gleaned from lectures is normally submitted as essays and reports, academic work in the design studio is typically examined through 'pin-ups', 'Crits' (for example staged reviews, interim-reviews and final reviews) and 'portfolios'.

Weaver et al. suggest that, "Much of the knowledge and skill inherent in good design tutoring remains tacit" (2000, p. 266), however it could be argued that in many UK schools of architecture, this is also true for the way architect-educators learn how to present

their lectures to their students. This article will propose that teacher-architects in the UK should be offered training to support their specific needs. By developing the existing methods of delivery in AE, by enhancing design studio teaching and lecturing, architect-educators would be able to better assist their students to respond to a variety of social, community and professional needs relating to diversity, equality, sustainability, well-being, health, safety and technology. Currently, this discipline-specific support and training does not exist for architect-educators.

Additionally, it is also important for architect-teachers in the UK to provide students in AE with the required skills and knowledge to address the technological, social, environmental, diversity and equality issues currently affecting the profession. Because of the word limit of this article, the author will not be able to discuss these aspects in depth. However, it is important to signpost readers to a recent publication by the former president of the RIBA Alan Jones entitled, ' Defining contemporary professionalism: For Architects in Practice and Education' ( Jones et al., 2019). Jones's book begins to address these issues in more detail, through the writing and reflections of architect-educators and practising architects.

## Skin in the game: professionalism and the professional identity of architects in practice and architect-educators in the academy

"…the way for architects to retain their leadership role was by educating the members of their profession to a higher degree than their competitors did … there can be no question that the perception of architecture changed radically when it became a university subject. Indeed, changing the perception of architecture was the whole point of the exercise" (Zamarian quoted by Jolliffe, 2019).

In the context of this article, it is important to carefully explain the models of UK professionalism and professional identities related to architects in practice and architect-educators in the academy.

### Architects in practice

The title 'Architect' is protected by law in the UK (Architects Act 1997, 2020) and the Register for Architects is maintained by the Architects Registration Board (ARB) (Who can use the title architect - ARB, 2020). In order to hold the title 'Architect', the RIBA states, "Whilst the typical route involves five years study at university and completion of a minimum of two years' practical experience, you can also study part-time " ("Pathways to qualify as an architect", 2020). Therefore, the quickest route to qualification for an architect in the UK, through a combination of HE education and practice, is a minimum period of 7 years. Simply put, the route to becoming an architect in the UK combines the acquisition of knowledge gained in HE and the application of that knowledge in practice. For architecture students in the academy, knowledge is learnt in schools of architecture using a form of Problem-based Learning, combining design, concepts and theories about the subject and the profession. For architecture students in the workplace, professional knowledge is gained through the application of theory into practice while working 'on-the-job'.

There are several different pathways to qualification as an architect. Full-time and part-time modes of study are available, as is a degree apprenticeship (DA) model of work-based learning (WBL) in schools of architecture at both undergraduate and postgraduate levels. The WBL nature of the DA is deemed to be beneficial to all parties involved including students, employers and HE institutions, although this route is relatively new to UK academies. Farren Bradley discussed the merits of work-based learning for architecture students, almost 25 years before it was introduced into UK AE. However, Farren Bradley suggested, "Some of the first work-based learning necessary would therefore be for the academic staff themselves!" (2000, p. 183). This discipline-specific training for architect-teachers to support the needs of DA students has not taken place.

Separately from qualifications, Members of the RIBA must abide by a 'Code of Professional Conduct' ("RIBA: Code of Professional Conduct 2019", 2020) and complete an annual CPD obligation. Members of the ARB must observe the 'The Architects Code' ("The Architects Code", 2020). It is interesting to note, however, that membership to join the RIBA is optional.

The RIBA and the ARB are the two professional bodies that maintain the educational, ethical, standards, conduct and practice of architects and schools of architecture in the UK. With specific regard to AE the RIBA have for many years suggested that schools of architecture in the UK need to reform how and what they teach. Key meetings and publications include the RIBA Congress on Architectural Education (1924), 1958 RIBA Oxford Conference, RIBA Education Review (2013), RIBA Education Forum (2015), RIBA Retropioneers: Architecture Redefined (2017), RIBA Education Futures (2018), RIBA 'The Way Ahead' (2020). These moments of reflection upon AE build on an enthusiasm within the RIBA for educational review to define learning structures responsive to modern practice ( Jones & Gloster, 2018). Discussions about, "Developments of advanced training and research" 1958 RIBA Oxford Conference (Hodder, 2020) are very similar to these suggestions five-and-a-half decades later, "teaching practices that contribute to curriculum delivery should be encouraged and developed", RIBA Education Review, 2013 (Hodder, 2020). These events and reports indicate a clear desire for reform of how AE is

taught in the UK, but the RIBA has not suggested how this should, or could, be done from a tutor-training perspective. If the RIBA Education Committees have felt, and currently feel, that they have been unable to make suggestions about what mechanisms are required to improve teaching practice, perhaps now is the time to commission research undertaken by interested UK schools of architecture.

**Architect-educators**

The route to becoming an architect-teacher is predicated solely on learning through the practice of teaching and as Berg (2018) comments, "That architects would want to teach is no surprise. Whether they should is a more nuanced question". In contrast, to the heavily prescribed route to professional qualification controlled by the RIBA and ARB described above for Architects in practice, the route to becoming an architect-educator is not controlled; anyone with an interest and inclination to teach can become an academic in a UK School of Architecture. Those that do teach are usually registered architects or those with qualifications gained while studying in AE. However, this is not always the case with many teachers entering schools of architecture from a wide range of professional and academic backgrounds.

As Rhowbotham states this can be challenging because, "It is customary amongst practising architects to assume that those who have achieved some degree of experience are somehow automatically equipped to teach. Nothing could be further from the truth" (1995, p. 12). In addition, Weaver et al. (2000, p. 267) suggest that architect-educators rely on memories of their own education and Wooley proposes that academics in AE are intuitive teachers (1991, p. 47).

**Validation of UK Schools of Architecture**

Reading the anti-academy comments by practitioners in this article, and looking at the lack of teacher-training available to support the specific needs of architect-educators, it could be concluded that the schism described in this article has been caused by schools of architecture and their staff. However, the RIBA (the validators of UK schools of architecture) and the ARB (the body responsible for prescribing the qualifications and practical experience required for entry onto the UK Register of Architects) find themselves in a difficult position in this regard. The RIBA and ARB set the criteria that schools of architecture and architecture students must obtain in order to teach and practice. Schools of architecture are assessed by the RIBA every five years using a peer review process, through validation visits. However, history has shown, for a UK school of architecture not to be validated for not meeting the academic standards defined by the RIBA validation criteria, is very rare.

**Challenges for the RIBA and ARB**

Considering the statements above, it would be sensible to ask the following questions:

- If the RIBA controls the validation of UK schools of architecture and the ARB controls the Register of Architects, why do practitioners continue to suggest that architecture students are not prepared for practice during their extensive period of education at university?
- Are the various validation criteria set by the RIBA and ARB, for UK Schools of Architecture and Registered Members, not strict enough?
- Does the RIBA and ARB need to change the existing validation criteria to ensure that architecture students are being taught the correct content and to the correct standard?

**Solutions through a united response**

There is great potential for academics and practitioners to work together to build a dynamic and relevant knowledge-base for the profession, if they are both encouraged to work to their strengths. "We cannot call for greater practice/academic integration at entry level if we do not also champion the research capability of our academic institutions as a vital part of professional practice" (Jolliffe, 2019). Samuel (2019) supports Joliffe's view, "Without a literacy in the best-quality knowledge, architects cannot claim to be professionals - their expertise is unclear, out of date and seemingly dispensable, and their status within the construction team continues to diminish". It would seem then, having considered the comments above about existing professional weaknesses in academia, practice and the RIBA and ARB, that all sides of the schism are at fault; they currently share an ambivalence towards the development of research and the acquisition of knowledge in the overlapping spheres of AE and architectural practice. It could be suggested, therefore, that there is huge potential for academics and practitioners to develop a much more synergistic relationship to benefit the profession as a whole, under the tutelage of the RIBA and ARB.

For nearly a century, the RIBA have called for reform of AE without suggesting how changes could be implemented. Now could be the time for the RIBA and ARB, alongside UK schools of architecture and practitioners, to carefully consider how teacher-architects can be supported with training and professional advice to further enhance their methods of delivery. This approach may help to heal the schism that currently exists in the architecture profession.

**Architectural education: reevaluating teaching literature and the contextualisation of uk teacher education reforms**

"…those interested in the betterment of architectural education might begin to engage in a form of inter-textuality, a dialogue between theories, which might result in the critical scrutiny and revision to the theories themselves" (Webster, 2008).

To further understand the debate surrounding professionalism and the professional identity of architect-educators, it is important to contextualise two particular aspects of AE. Firstly, to briefly review the key texts currently referred to by academics in AE, which are used to improve their teaching and secondly, teacher education reforms in the UK and the impacts that these have had on schools of architecture.

**Teaching-literature in Architecture Education**

Many authors have written about teaching and learning in AE including, including but not limited to, Jane Anderson (2011), James Benedict Brown (2012), Geoffrey Broadbent (1995), Harriet Harriss (2015), Ruth Morrow (2007), Martin Pearce (1995), Ashraf Salama (2015), Flora Samuel (2017) and Rachel Sara (2020). For reasons of brevity, the author has chosen to include a small sample of the total number of publishing architect-educators that operate in schools of architecture in the UK and across the world.

The following paragraphs do not dismiss the important contribution that these authors, and others, have made towards the development and improvement of AE. However, certain teaching theories, in this instance those developed by Schön, Laver and Wenger and Kolb, have dominated AE pedagogy and have stood the test of time.

Donald Schön (1983) chose to highlight the mechanics of the design studio in AE. Schön's descriptions of a specific narrative in AE through a chapter entitled 'Design as a Reflective Conversation with the Situation' (1983, pp. 76-104) focuses on the conversations between an architect-educator and an architecture student in an academic design studio environment. This chapter, through Schön's observations, provides architect-educators with fly-on-the-wall insights into the studio design process from the perspectives of both the teacher and the student. Schön's work encourages architect-teachers to be self-reflective (in-action, on-action) and reflexive in the way they work with their students with the aim that their teaching practice will be improved.

Kolb's 'experiential learning theory' (originally published in 1984) considers the specific context of students (2015, p. 279-280) in AE. In Kolb's diagram entitled 'Concrete/Abstract and Active/Reflective Orientations of Academic Fields' (2015, p. 182) architecture students are described as being active/ concrete learners and grouped with students from Law, Education, Education psychology, Education administration, Medicine, Psychology and Social Work. Kolb's observations about how architecture students prefer to interact with peers and architect-teachers (2015, p. 279) reiterates the importance of learning about design in a studio environment though connected cycles of learning through doing, reflection, iteration, learning through doing, etc; these actions remain the key teaching mechanisms to educate students in AE.

Lave and Wenger (1991) build on the work introduced by Schön by looking at how the apprentice model works through apprenticeship. Although the theories by Lave and Wenger do not specifically mention the profession of architecture as Schön and Kolb did, the five apprenticeship models (1991, pp. 59-87) that they focus on have particular synergies with AE. Unlike the work of Schön, where the student is dependent upon knowledge being passed-down by the master-teacher, Lave and Wenger, through their theories connected with 'legitimate peripheral participation' place the student at the centre of the learning either as newcomers, old-timers, or students who are moving between these two extremes. The chapter by Lave and Wenger concerning Midwives, Tailors, Quartermasters, Butchers and Non Drinking Alcoholics (1991, pp. 59-87) could be used by architect-teachers to reflect upon ways that AE could be improved from looking at non-architecture related vocations and professions.

Webster (2008) states, "It is quite extraordinary that architectural education remained un-theorised until the 1970s when Donald Schön, following his studies of the design studio, put forward the notion that design studio learning simulated real professional action … ". Webster critiques Schön's work (2008, p. 72) by suggesting that Schön is un-reflexive and unable to declare or recognise the limitations of his own position. In this paper, Webster encourages architect-educators to consider other teaching models, in addition to the work of Schön, as a means of broadening the theoretical base of AE, "whilst recognising that they also view particular issues through particular lenses" (2008, p. 72).

In her paper, Webster also suggests that architect-educators should consider other teaching theories in addition to the work produced by Schön. With this comment in mind, it is important to ask why architect-educators continue to use the work of Schön, to assist them with self-reflective practice? Firstly, as Clegg suggests (1999, pp. 169-170), reflection on teaching is pleasurable, empowering and motivational. Secondly, Schön wrote specifically about reflective practice in AE, making it relevant to the day-to-day activities of architect-teachers. However, Clegg (1999) goes on to suggest that Schön's work is limited in terms of the gender balance be-

tween the 'master' tutor ('Quist', a man) and the younger, inexperienced, 'pupil' ('Petra', a woman). The teaching approach of 'Quist', as described by Schon (1987), would not be considered diverse enough to satisfy the learning requirements of UK architecture students in 2022.

It could be interpreted from Webster's writing, that by looking closely at theories connected to situated knowledge and action and learning, there is a suggestion that teachers in AE should once again reflect upon the work of Lave and Wenger and Kolb, in addition to Schön. Perhaps, Webster is suggesting, that a broader theoretical approach to AE can be adopted, one which responds to the needs of cohorts from more diverse and wide-ranging backgrounds than when Schön was writing in the 1980s; a blended theory that takes the best parts of Schön, Lave and Wenger, Kolb, and others, which could be used by architect-educators to address current-day needs.

**Teacher education reforms and schools of architecture in the UK**

In 1963, the Robbins Report set out the "Aims for Higher Education" (Gillard, 2020). In the same report under the heading, "Methods for Teaching", Robbins goes on to suggest, "Some of our witnesses have urged that every university teacher should have a period of instruction in teaching techniques before he takes up his duties" (Gillard, 2020). Prior to the Robbins Report suggestions, there was no formal teaching of university lecturers before 1963, "The expansion of training in the early '60s had generated a need for new lecturers largely met by recruitment of experienced teachers who had completed or were pursuing advanced study in various aspects of Education in university departments and Institutes" (Taylor, 1988). Following the recommendations published in the Robbins Report, the education of lecturers in HE has been evolved and developed through a series of HE related organisations and reports; the Staff and Educational Development Association (SEDA) in 1993, the Dearing Report in 1997, the Booth Report in 1998, the Institute for Learning and Teaching in Higher Education (ILTHE) in 2000, the Higher Education Academy (HEA) in 2004 and most recently the formation of the Advance HE in 2018. Research undertaken as part of this article has revealed that architect-teachers have been largely unaffected by the report recommendations and organisations mentioned above, which are connected to the improvement of general teaching practice in HE.

Many UK HE institutions recommend that all teaching staff apply for, as a minimum requirement, Fellowship of the Higher Education Academy (HEA), which was originally coordinated by the HEA (from 2004 onwards) and more recently with the Advance HE (from 2018 onwards). However, major weaknesses of the HEA Fellowship pathways include i) no enforcement across institutions and ii) not being discipline-specific to assist teachers who work in AE. To support this view, that AE has not benefited from any architecture-specific teacher training programmes, a search of online and in-Library articles, books and papers about this specific topic, reveals that there are significantly limited resources available to assist architect-educators.

Armed with this knowledge, it is important to consider the following scenario: A new teacher-architect enters a school of architecture to teach for the first time:

- Where can this teacher seek advice, away from their institution, about teaching architecture?
- How can this teacher build their own knowledge about working in AE, independently, if no teaching programmes or reference books exist to help them to develop in their chosen profession?

It should be noted, however, that Weaver et al. (2000) describe establishing an architect-teacher training programme at the University of East London (UEL). The programme was connected to a UEL coordinated Post Graduate Certificate in Competence in Teaching in Higher Education and the ILTHE. "The programme is based on experiential learning, mentoring arrangements and shared discussion of teaching practice and of research on student learning. The aim of the training course is to develop reflective studio tutors" (Nicol & Pilling, 2000). The UEL programme is the only AE specific teacher training programme that this author has been able to discover.

Comparisons can be made between the work carried out at the turn of the century by Weaver et al. (2000), and an academic paper written by Bergmark and Erixon (2019) which reports on the academisation of the teaching profession in Sweden. Similar to the UEL programme, the Bergmark and Erixon paper documents a Masters' programme "to promote teachers' academic knowledge, as applied in practice-based research and school development, as well as supporting the principal and colleagues in the work of integrating the practice-based research" (p. 6). Both of these formal training programmes set-out to embrace research and challenge academic knowledge, with the ambition of improving teaching practice.

Weaver, et al. (2000) and, then almost two decades later, Bergmark and Erixon, identified a gap in knowledge within UK architect-educators and Swedish teaching professionals. Bergman and Erixon suggest, "this gap in theory/practice and teacher/researcher can be bridged and reduced if research and teaching are regarded as two equal practices that meet each other, which might result in both changing based on the interaction" (2019, p. 589). In order

for teachers to engage with student learning in relevant and meaningful ways, educators could continue to learn, continuously jumping between practice and research, "we conceive the boundaries between these two knowledge domains as not so clear-cut, but more as a continuum along which researching teachers, in our case, can move" (Bergmark & Erixon, 2019).

This part of the article set out to reevaluate AE teaching literature and to contextualise UK teaching education reforms. Firstly, it has been suggested by Webster (2008) and Clegg (1999) that the key principles of Schön which continue to be referred to by contemporary architect-educators for very sound pedagogic reasons, need to be re-evaluated, adapted and blended with other teaching and learning theories, so that they are better suited for a learning environment that is very different from the 1980s when they were first published. Secondly, due to the lack of discipline-specific training for architect-educators in the current HEA Fellowship pathways, it could be argued that there is merit in looking at forming an AE-specific tutor training programme similar to the Course established by Weaver, et al (2000).

The methods and principles used to improve the quality and delivery of teaching across other subject areas in the UK from the Robbins Report onwards, and more recently in Sweden, could be applied to AE in UK Schools of Architecture. Given pressing matters in the architectural profession concerning diversity, race, community, digital education, sustainability, well being, health and safety and the environment, current methods of teaching could be re-evaluated and adapted. This would be an important move for architect-educators to make today, in order for them to help prepare the architects of tomorrow.

## CONCLUSIONS

"This might sound rather obvious for some, contradictory for many and somewhat 'blasphemous' for others, but for genuine educators, ***i. Education must be more important than architecture, and ii. Education must be ahead of architectural practice***" (emboldening and italicisation by Teymur, 1992).

This article has argued that there is a need for professional teacher training programmes within UK AE. As has been documented in this article, there is, and has been over a prolonged period of time, a will and desire by Government, HE institutions and related professional bodies, such as the RIBA and ARB, to improve the quality and delivery of teaching in UK universities. If this were to happen, there is evidence to suggest (Bergmark & Erixon, 2019;Weaver, et al., 2000) that students could be better prepared for practice because their architect-teachers have engaged in specific training but also postgraduate and doctoral level research specific to AE. It would be highly unlikely for these AE-specific teacher training programmes to be controlled and managed at a Government-level. However, an organisation such as AdvanceHE may be interested in this type of programme as it would complement other initiatives within their existing training portfolio ("AdvanceHE: Supporting External Examiners on Architecture Courses in UK Universities [Briefing Guide No. 07] | AdvanceHE", 2020). For instance, the programme established by Weaver et al. (2000) was intended to be connected to the forerunner of AdvancedHE, the ILTHE. More likely than becoming an additional programme in the AdvanceHE portfolio, an architect-teacher training programme could be tested and ultimately adopted nationally by the RIBA, or at a more local level by UK schools of architecture.

The views of Samuel (2019) and Jolliffe (2019), described above, were included to illustrate how research should be championed and embedded within AE so that it becomes a vital part of professional practice. AE-specific teacher education, modelled on a version of the UEL programme (Weaver, et al., 2000), adapted to include the investigations of Bergmark and Erixon (2019), Nicol (2000) and others, could be used to develop the skills of tutors embedded within UK schools of architecture, while at the same time producing new research. This new research could be used to partially plug the practical-knowledge gap that currently exists within the architecture profession. By encouraging discipline-specific teacher training programmes and postgraduate and doctoral level research, UK schools of architecture could support an architecture profession that has not prioritised the generation of research and knowledge (Samuel 2019).

Professor Murray Fraser (2014), writing an article for the Architects' Journal has suggested, "universities have to find better ways to blend themselves more effectively with architectural practices, while both players need to keep a sense of their own identity so that each can also continue to do what they are best at". In his article, Murray describes the nuanced relationship between schools of architecture and architectural practice and the importance of working together harmoniously, yet remaining distinct.

Just as this article began with the words of Judith Farren Bradley, discussing a schism between academia and practice in architecture, it will end with Farren Bradley's own concluding statement: "Dialogue, both critical or supportive, is best achieved through vigorous interaction. Graduates from such a revised architectural education system will create modes and forms of practice appropriate to the future, the details of which it would be impossible and probably unwise to predict" (2000, p. 188).

## CONFLICT OF INTEREST

The authors declared no conflict of interest.

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# Exploring Lecture Evaluation Tools Suitable for Online Classes at Universities

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**Purpose:** To develop an evaluation tool suitable for online classes at universities due to the increased focus on the quality management of university classes because of the impact of COVID-19.
**Methods:** Nineteen items relevant to evaluation of the teaching and learning at university were extracted from a review of previous studies and the content analysis by experts was undertaken. Based on the context-input-process-product evaluation model, 16 items were selected from the analysis of learning evaluations of 1,000 students at the end of the second semester of 2021 at the researcher's workplace.
**Results:** First, following confirmatory exploratory factor analysis (CFA), 16 learning evaluation items were converted into a single factor related to learning and teaching. Second, as a result of confirmatory factor analysis (CFA) by the academic field, 16 learning evaluation items were converted into a single factor. Third, 16 learning evaluation items were found to have a significant positive effect on the learning evaluation score.
**Conclusion:** The learning evaluation tools developed through this study were demonstrated to be meaningful in that they can be applied at the individual educator and university level to improve the quality of lectures in online classes in the future.

**Keywords:** COVID-19; Online class; Learning evaluation; CIPP evaluation model; Online learning

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## INTRODUCTION

### The need and purpose of the study

As most universities have realized the need for online classes, distant classes have been fully implemented (Kim, 2020; Do, 2020). Online classes require a shift in teaching-learning methods from teacher-centered to student-centered (Graham et al., 2001;Shelton, 2011). For student-centered classes, it is necessary to select a class method that provides video content, which utilizes a video platform such as Zoom, Google meets, or Webex. However, some educators who are accustomed to offline classes have faced significant difficulties in conducting online classes. These educators' difficulties require the creation of a learning environment suitable for online situations, analysis of students' needs, and change of teaching methods (Borch et al., 2020). As a result, the professional development of the teaching competency of teachers in online classes is critical (Thomas & Graham, 2019), and implies that learning evaluation tools that can check whether or not they are adapted to online classes should be developed.

This study started with the recognition that a learning evaluation tool suitable for the online classes environment is needed. The tool can be used to evaluate the effectiveness and efficiency of classes; it is the most common and effective mechanism among the methods used to improve

the quality of lectures (Kim, 2017;Lee, 2001;Song, 2018; Suárez et al., 2022). Through learning evaluation, educators receive feedback on class quality from students who are the subject of classes, and through this, reflect on and improve their classes to strengthen teaching competency and improve classes quality (Song & Lee, 2020). Therefore, the university's learning evaluation system is designed to first ensure educators realize the difference between the meaning they wants to convey to the student and how the student perceives it. Second evaluation provides an opportunity for the teacher to reflect on the classes, and third to recognize the teacher as an essential element in university learning and teaching processes. Feedback from students is significant in that it reminds us of the importance of competency in managing learning events.

Online classes are similar to classes at distant universities in that the educators and the students are separated by location. However, some characteristics distinguish these from classes at distant universities in-class preparation, class operation, interaction, and learning evaluation processes. Therefore, there is a limit to using the existing learning evaluation tools for distance learning (Song & Lee, 2020). That is, an in-depth discussion is needed on whether appropriate and timely interaction between educators and student occurs when the offline learning process is converted to a online learning process (Jung & Yoon, 2020; Kim & Cheon, 2020;Lee, 2020; Lee & Kim, 2020;Lee et al., 2020). In addition, since learning evaluation is conducted in online manner, the issue of whether the evaluation method is appropriate for the online teaching method and whether the evaluation standard is fair is raised. Accordingly, teachers have the right to receive appropriate evaluations for online classes, and universities must develop and provide learning evaluation tools that are appropriate and reliable.

The development of learning evaluation tools for online classes should be considered in relation to several contextual factors. Among them, the student's ability to use computers and the internet, online interaction, interface design, and systems operation and management are important factors (Park et al., 2006;Seo, 2002;Cheung, 1998). In addition, the complementary nature and characteristics of the academic discipline are key factors and should be reflected in evaluation criteria.

Therefore, the purpose of this study was to develop a learning evaluation tool that can fully reflect the university's online classes activities that arose due to the COVID-19 situation. To achieve this purpose, we explored the factors of learning evaluation of online classes based on the review of previous studies, extract evaluation items as factors based on the CIPP evaluation model, and verify the validity of the teaching evaluation tool. To this end, first, domestic literature relating to evaluation of online classes was reviewed. Second, the factors of learning evaluation were extracted and an expert's content analysis was undertaken. Third, confirmatory factor analysis was conducted to test the validity of the learning evaluation tool. Through results from these actions, we derived learning evaluation tools suitable for the acquisition of knowledge and processes that students want to acquire as learners. Ultimately, this study has the potential to contribute to improving students' satisfaction with the learning events available to them in the online environment.

*Research Questions*

Research Question 1. What are the factors and questions for learning evaluation suitable for online classes at universities?

Research Question 2. Are the factors and evaluation items of learning evaluation valid?

**Study Variables and Previous Studies**

*Purpose and use of university learning evaluation*

Teaching evaluation at universities began in the United States in the 1960s to meet the responsibility of university education and the needs of students' rights to optimal learning environments. In Korea, the idea officially discussed in the 1980s, and since the 1990s, it has been implemented at all universities from a student-centered educational perspective, university education competitiveness, and enhancement of teacher competency (Song, 2018; Lee, 2013). Learning evaluation was included in the evaluation tools of the 'University Comprehensive Evaluation and Accreditation System' implemented in 1994; it was established to improve the quality of lectures (Yang, 2014;Lee, 2001). The evaluation system was meaningful to the university in that it impacted individual teachers' efforts and interests and became part of the university learning and teaching systems (Song, 2018).

The purposes of evaluation are formative and summative (Song, 2018; Han et al., 2005;Braskamp, 1984). Formative evaluation enables early feedback on the worthiness of lectures and provides information for improvement. Summative evaluation focusses on the value, effectiveness, and efficiency of educational programs but also utilizes the feedback as decision-making information needed as evidence for teacher promotion, re-appointment, and guaranteed retirement age (Baek & Shin, 2008). The rationale behind evaluation details is as follows: First, that educators have appropriate qualifications, and that their professionalism and accountability are continuously improved. Second The student, who is both the subject of the class and the subject of learning evaluation, provides feedback on the classes. Third, it is used to make administrative decisions such as evaluation of educational achievements and promo-

tion, teaching support, and selection of excellent educators. Fourth, information for selecting a class (teaching) is provided when a student registers for a course. In summary, learning evaluation is conducted to improve the quality of lectures, measure the effectiveness of classes, provide basic data for selecting excellent teachers, and develop an excellent teaching model (Kim et al., 2007; Kim & Kim, 2008; Park, 2012).

Learning evaluation is a means of judging the value of a class activity(Braskamp, 1984) and an index to measure quality. Learning evaluation is carried out in the same context as the learning purpose (Baek & Shin, 2008). Educators are encouraged to reflect on their lectures and make an effort to improve them. The university examines teaching achievements or teaching excellence, providing incentives for improvement, and might apply sanctions where evaluation outcomes are poor. Therefore, the purpose and use of learning evaluation are not only for reinforcing teaching capacity and improving the quality of lectures, but also providing data for academic performance evaluation, providing information to support students' right to choose classes, collect information for advice on teaching activities, and research on various options for classes. In this study, the concept of learning evaluation is defined as the act of students judging the value of all teaching-learning activities according to a set standard subject against certain criteria and methods with the aim of increasing the effectiveness of the classes.

*Review of previous studies on learning evaluation*

Learning evaluation involves a system with tools to measure the quality of classes for feedback to educators and to secure the quality of university classes for the students' learning experience (Choi et al., 2018). Previous studies involving traditional teaching methods include the following. First, various domestic studies were examined, focusing on the validity and reliability of learning evaluation tools (Song, Ji, 1994; Yum, 2008; Lee et al., 2005;Aleamoni, 1981;Preece, 1990).Song and Ji (1994) reported that in one university, the learning evaluation tools were consistent with the purpose of the evaluation. By comparing the learning evaluation annually basis over two-years, they showed the ranking and measurement value of satisfaction were the same. Yum, 2008, and Heckert et al. (2006) cautioned that learning evaluation is a product of student, teacher, and student-teacher interaction and has multidimensional properties.

Looking at overseas studies, Aleamoni (1981) found that learning evaluation is a source from which important information can be obtained through various interactions with teachers within the learning environment. From a positive perspective teaching and learning can be evaluated logically, improving the quality of lectures and providing opportunities for active participation around feedback. Also, Stewart et al. (2013), and Sun et al. (2008) reported that there is a correlation with learning satisfaction. However, Preece (1990) highlighted negative aspects noting that as an evaluator, the student lacks experience and professionalism, can focus on popularity rather than the evaluation of teaching ability. Concerns were raised about the reliability and validity of the evaluation item itself, and the consistency and stability of the item response. As such, it can be seen that both positive and negative opinions exist in the validity and reliability of learning evaluation.

Second, looking at previous studies on factors that affect learning evaluation, in Kim's (2005) study, students' learning motivation, expected grades, classes burden, and personal difficulties had an effect. The paper did not provide details on the number of students and teaching methods. In the study by Ting (2000), the higher the teacher's position, the more positive the learning evaluation. However, in the study by Coshins (1988), the teacher's age, years of service, gender, race, personality, and research performance did not affect learning evaluation. Han (2001) stated that teachers who taught humanities and social science subjects tended to receive higher scores than teachers who taught natural engineering subjects. In addition, it was said that the older the teacher, the lower the score, but the higher the age distribution and the more diverse the majors of the students, the higher the score. In research by Marsh (1984), the learning evaluation of small lectures was higher than that of large lectures, but in that by Han (2001), it was the opposite. In the study by Yum (2008), variables such as expectations for credits, lecture composition, and progress had a significant effect on evaluation, but the expectation around completion was not significant. Hence the factors affecting the learning evaluation were different for each study.

Third, the focus was on learning evaluation; according to studies by Han, Lee, Kim, (2005), and Kim et al. (2007), most universities only disclose learning evaluation data to individual educators, reflecting performance evaluation rather than class improvement. It was being used for administrative purposes, such as sanctions against teachers, that is those with low learning evaluation scores. In the study by Kim (2008), educators with high research achievements had higher learning evaluations than those with relatively low research achievements. Hence while studies on the use of learning evaluation are conducted for classes improvement, in reality, it can be seen that they are used for various administrative purposes rather than class improvement. These results suggest that clarity within discussion about learning evaluation is needed.

*Learning evaluation tool development process and use of CIPP evaluation model*

Using Stufflebeam's (1971, 2004) CIPP evaluation model, tools were developed for context, input, process, and product factors. The CIPP evaluation model is not limited to class content and calculates comprehensive class information by evaluating the situation within and resources invested in class operation, evaluation of resources, evaluation of the operating process, and the value of operating results. The advantage of the CIPP evaluation model is that it considers aspects of context, input, process, and product to make a comprehensive evaluation of the online classes scene.

The CIPP model highlights what we should do in online classes, how should we do it and whether we are doing it right, that is how well the approach to teaching was undertaken. Context (C) evaluates the worthiness or justifiable grounds for determining the class goal. The current situation and preferred method will have been defined. Input (I) centers on the information necessary for decisions on how to use resources to achieve the online class objective, selected methods and implementation plans. Process (P) evaluation, which checks the various methods required during the class and evaluates tools planned in advance, that is, the input. Product (P) evaluation, measures and interprets the achievement of class goals, both intended and unintended outcomes (Figure 1).

Evaluation of Context helps to establish the purpose of developing tools at the beginning stage of item development, and establishing the worthiness of the learning evaluation purpose on completion of the tool development. A focus on Input helps to identify differences and problems between the situation shown in class against the intended situation. Product evaluation collects and evaluates a wide range of information related to the achievement of goals, thus helping to make decisions about improving learning evaluation. The reason why the CIPP evaluation model was used in this study is that it has the advantage of being able to evaluate learning events as needed at any stage.

## METHOD

### Research Procedures

To develop learning evaluation tools for online classes at universities, research procedures were carried out as shown in Figure 2 below. First, sub-factors and preliminary tools were derived by analyzing the literature review related to online classes at universities, learning evaluation tools in offline classes, and learning evaluation tools in distant classes. An expert review was conducted to secure the validity of the content of the preliminary tools. Five experts included for the expert panel were selected - two majors in education, one in educational engineering, and two in human resource development policy, with a doctorate.

Tools were corrected, items added, or deleted based on the calculated results. In addition, 30 students who had experience in online classes were involved in testing for face validity, and it was confirmed that there was no difficulty in understanding the items. Finally, the validity of the tools was verified by analyzing the data of 1,000 students in the mid-term and final learning evaluations conducted at K University located in a non-metropolitan area. The scale for each item response was measured on a 5-step Likert scale

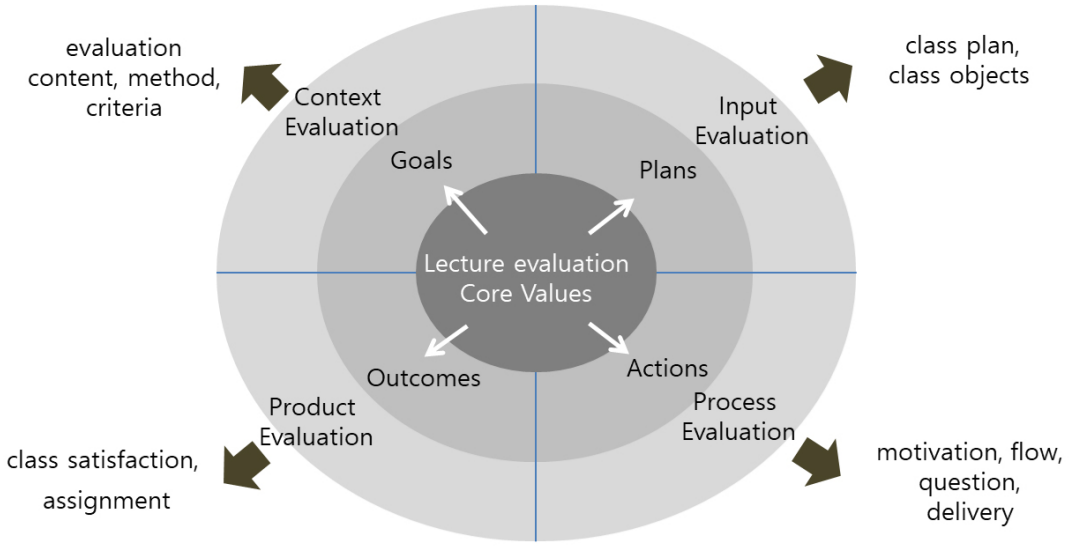


**Figure 1.** Factors for lecture evaluation using the CIPP evaluation model.

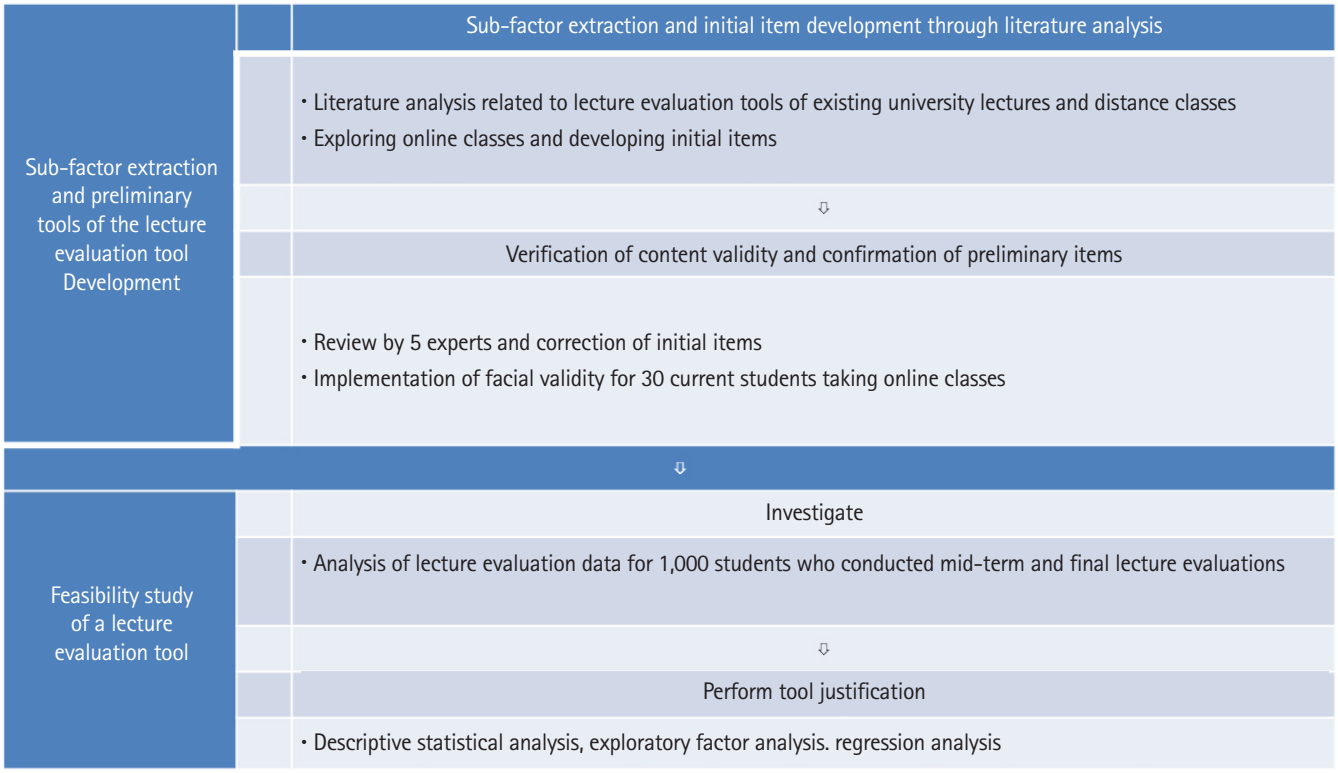


**Figure 2.** Lecture evaluation development process for online classes.

(not at all - strongly agree). In this study, descriptive statistical analysis, preliminary questions, exploratory factor analysis, and regression analysis of this questions were used.

The mean (M), standard deviation (SD), skewness, and kurtosis of each item were confirmed through descriptive statistical analysis. When the standard deviation is at least .15, the item is judged to be appropriate (Meir & Gati, 1981). For skewness, the absolute value is 3.0 or less, and for kurtosis, if the absolute value is 10.0 or less, the response data is judged to be normal (Kline, 2005). For exploratory factor analysis, the validity of the learning evaluation tools for online classes consisting of a screening test and cumulative division ratio review, a total of 1 factor, and 16 items were confirmed.

### Study participants

Evaluations data from 1,000 university students from Year 4 at K-University located in a non-metropolitan area was used for this study. These were students who completed mid-term and final learning evaluations in 2021. The preliminary examination, the mid-term learning evaluation, is held from October 13 to 26, and the final evaluation, after the main examination, is from December 4 to 12. For the reliability of the study results, subjects with 30 or more students were extracted as a stratified sample. In addition, a course with fewer than 30 students may give a good impression due to direct or frequent interaction with the teacher and maybe more positively viewed in learning evaluations. After dividing into 5 academic disciplines designated by the Ministry of Education, such as [Humanities and Social Sciences], [Natural Science], [Engineering], [Pharmaceuticals], and [Arts and Physical Education], they were extracted in similar discipline proportions to the student population. However, [Pharmaceuticals] academic discipline was excluded from the study as the number of potential cases was 21 (Table 1).

## RESULTS

### Development of items for each factor in online classes learning evaluation

To develop the tools, first, the factors and tools of the learning evaluation of the online classes were identified based on the analysis of previous studies related to learning evaluation. 'class preparation', 'class operation', 'class output', and 'class evaluation' factors were extracted by analyzing previous studies related to online classes conducted since the beginning of COVID-19. By applying this to the CIPP evaluation model, 4 factors of Context-Input-Pro-

**Table 1.** Characteristics of demographic variables

| | Division | Frequency | Percentage |
|---|---|---|---|
| Gender | Male student | 360 | 36 |
| | Female student | 640 | 63 |
| Academic discipline | Humanities and social sciences | 440 | 44 |
| | Natural science | 285 | 28.5 |
| | Engineering | 100 | 10 |
| | Arts and physical education | 175 | 17.5 |
| Grade | 1 grade | 280 | 28 |
| | 2nd grade | 249 | 24.9 |
| | 3rd year | 311 | 31.1 |
| | Grade 4 | 160 | 16 |
| Sum | | 1000 | 100 |

cess-Product and 19 preliminary tools were developed as potential sub-factors of the online learning evaluation tool. Next, content validation was carried out through Delphi analysis by experts on a 5-point scale for preliminary tools.

First, the items involving the 4 factors above were seen as 'too detailed'; these were revised. For example, the item is 'Did the teacher provide information on classes activities for each week, classes changes, and assignments/exams promptly?' After collecting the opinions of experts, it was revised to 'Did the teacher compose the appropriate amount of learning to achieve the learning goal?'. In addition, 'Teacher provided information about the online classes environment (e.g., LMS environment setting, pre-class procedures, bulletin board participation, etc.) promptly.' Did you provide it in advance?' and 'In the syllabus, class information including class type (online, offline, mixed) and class method (e.g., real-time video lecture, provision of learning materials, provision of learning materials + real-time lecture, etc.) was specifically guided? was changed to 'Did the teacher specifically present the class content and teaching method for one semester in the syllabus?' Second, four items were excluded by reflecting the opinion that there is a possibility that they are similar or overlapping with other items. For example, 'Is the amount of online learning activities (real-time video lectures, class materials, discussion/discussion, assignments, etc.) adequate?', 'Did the teacher deliver the content in an easy to understand way?' The classes were conducted considering the level of the students.', 'I will recommend this class to my seniors and juniors and my classmates.' In addition, for smooth communication with students in the online classes, the item 'Did the teacher proficiently handle the various functions of Webex?' was added to the 'Input' factor and the 'Process' factor, respectively. Finally, 4 factors and 16 items were confirmed: 4 items for Input, 7 items for Process, 3 items for Product, and 2 for Context. It was confirmed that there was no difficulty in understanding the item, thus proceeding with the learning evaluation by conducting a face validity test on 30 university students who had experienced online classes (Table 2).

### Validation of learning evaluation tools for online class

*Descriptive statistics analysis result for each item*

Table 3 shows the results of descriptive statistical analysis of the final learning evaluation conducted for university students who participated in online classes to check the response level, distribution, and regularity of the learning evaluation tools in online classes. First, the average for each item was distributed in the range from 4.48 to 4.58, and the standard deviation was found to be in the range from .688 to .811. Next, as an index for confirming normality, the univariate skewness value and kurtosis value were derived, and the absolute value of skewness was 1.621-1.872, and the absolute value of kurtosis was 2.565-3.731. Therefore, it was found that there were no items that greatly deviated from the assumption of normality (Kline, 2005).

*Correlation of each item in the learning evaluation*

Examining the correlations for each item in the learning evaluation, there was found that there was a significant quantitative correlation at the level of .01 in all items. There was found that there was a significant quantitative correlation between the 'learning evaluation score' and the 'learning evaluation items' at the .01 level (Table 4).

*Verification of item validity and reliability*

Exploratory factor analysis (EFA) was performed to secure the validity of the items. The maximum likelihood analysis method was selected and conducted with a 'direct oblimin' factor rotation. As a result of KMO and Bartlett's sphericity test to confirm the suitability of factor analysis, KMO = .982, which was found to be good (Kaiser, 1974). Bartlett's sphericity is shown as X2 = 474045.681, df = 120, and Sig = .000, suggesting that it is worthwhile for factor analysis (Kang, 2013). The commonality was between .742 and .828, indicating that all items were important variables. To determine the number of factors for estimating the basic structure of all items, the scree test was first checked. Looking at the difference in the eigenvalues of the reduced correlation matrix as a result of the screening test, it can be seen that the eigenvalue decreases significantly from the 1st to the 2nd (difference in the eigenvalue 12.429), but does not decrease much (.122) and is normalized from the 3rd eigenvalue. Accordingly, it can be judged that

**Table 2.** Lecture Evaluation tools by CIPP

| No. | CIPP | Tools | Questions |
|---|---|---|---|
| 1 | Input | Webex leverage | The teacher proficiently dealt with various functions of Webex. |
| 2 | | Pre-classes information | The teacher informed me in advance whenever there was a change in classes. |
| 3 | | Classes environment information provided in advance | The teacher provided information about online classes environments such as TLS and Webex in advance. |
| 4 | | Presenting a specific lesson plan | In the syllabus, the teacher specifically presented the class's content and method for one semester. |
| 5 | Process | Classes proceed according to the syllabus | The teacher taught the classes according to the class's content and method presented in the syllabus. |
| 6 | | Present class goals for each class | The teacher presented the lesson objectives for each class. |
| 7 | | Appropriateness of online classes materials | The online classes materials provided by the teacher were appropriate for understanding the class content. |
| 8 | | Class method appropriateness | The teacher used various teaching methods to understand the contents of the classes. |
| 9 | | Efforts to interact with students | The teacher tried to actively interact with the students |
| 10 | | Quick response to inquiries | The teacher quickly responded to the students' questions. |
| 11 | | Summary of the main contents of the classes | Before the end of the classes, the teacher organized and delivered the main contents of the classes. |
| 12 | Product | Help to understand the content of the course | This class helped me to understand the content of the subject. |
| 13 | | Overall satisfaction | I am overall satisfied with this class. |
| 14 | Context | Fidelity of evaluation contents | The test questions, assignment topics, and reports presented by the teacher fully reflected the content of the classes. |
| 15 | | Clarity of evaluation criteria | The evaluation criteria for assignments, tests, and attendance suggested by the teacher were clear in the online classes. |
| 16 | | Appropriate evaluation method | Online classes were fully considered for the evaluation methods of assignments, tests, and reports presented by the teacher. |

CIPP: context-input-process-product.

**Table 3.** Mean and Standard Deviation of Lecture Evaluation tools

| CIPP | Item | M | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|
| Input | Webex leverage | 4.50 | 0.770 | -1.621 | 2.565 |
| | Pre-classes information | 4.57 | 0.714 | -1.798 | 3.394 |
| | Classes environment information provided in advance | 4.57 | 0.700 | -1.705 | 2.970 |
| | Presenting a specific lesson plan | 4.58 | 0.698 | -1.747 | 3.199 |
| Process | Classes proceed according to the syllabus | 4.58 | 0.690 | -1.739 | 3.123 |
| | Present classes goals for each class | 4.57 | 0.709 | -1.743 | 3.080 |
| | Appropriateness of online class materials | 4.53 | 0.767 | -1.758 | 3.162 |
| | Class method appropriateness | 4.52 | 0.766 | -1.702 | 2.905 |
| | Efforts to interact with students | 4.55 | 0.752 | -1.872 | 3.731 |
| | Quick response to inquiries | 4.56 | 0.734 | -1.818 | 3.459 |
| | Summary of the main contents of the classes | 4.53 | 0.756 | -1.691 | 2.843 |
| Product | Help to understand the content of the course | 4.52 | 0.774 | -1.776 | 3.337 |
| | Overall satisfaction | 4.48 | 0.811 | -1.695 | 2.845 |
| Context | Fidelity of evaluation contents | 4.58 | 0.688 | -1.759 | 3.377 |
| | Clarity of evaluation criteria | 4.56 | 0.719 | -1.727 | 3.057 |
| | Appropriate evaluation method | 4.56 | 0.721 | -1.740 | 3.153 |

CIPP: context-Input-Process-Product.CIPP: context-input-process-product.

**Table 4.** Correlation between lecture evaluation items

| Item | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ | ⑫ | ⑬ | ⑭ | ⑮ | ⑯ | ⑰ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ① Webex leverage | .783** | 1 | | | | | | | | | | | | | | | |
| ② Pre-classes information | .804** | .852** | 1 | | | | | | | | | | | | | | |
| ③ Classes environment information provided in advance | .778** | .822** | .847** | 1 | | | | | | | | | | | | | |
| ④ Presenting a specific lesson plan | .775** | .813** | .837** | .882** | 1 | | | | | | | | | | | | |
| ⑤ Classes proceeds according to the syllabus | .768** | .800** | .819** | .850** | .861** | 1 | | | | | | | | | | | |
| ⑥ Present class goals for each class | .763** | .766** | .783** | .794** | .801** | .819** | 1 | | | | | | | | | | |
| ⑦ Appropriateness of online class materials | .781** | .775** | .792** | .798** | .800** | .814** | .851** | 1 | | | | | | | | | |
| ⑧ Class Method appropriateness | .762** | .782** | .793** | .796** | .799** | .805** | .801** | .836** | 1 | | | | | | | | |
| ⑨ Efforts to interact with students | .763** | .783** | .793** | .796** | .797** | .803** | .784** | .806** | .855** | 1 | | | | | | | |
| ⑩ Quick response to inquiries | .764** | .775** | .790** | .798** | .802** | .821** | .813** | .832** | .820** | .815** | 1 | | | | | | |
| ⑪ Summary of the main contents of the class | .772** | .792** | .807** | .815** | .819** | .807** | .785** | .793** | .782** | .776** | .783** | 1 | | | | | |
| ⑫ Fidelity of evaluation contents | .758** | .767** | .788** | .784** | .785** | .771** | .757** | .761** | .761** | .752** | .756** | .837** | 1 | | | | |
| ⑬ Clarity of evaluation criteria | .771** | .776** | .794** | .792** | .794** | .781** | .762** | .765** | .765** | .761** | .757** | .821** | .872** | 1 | | | |
| ⑭ Appropriate evaluation method | .756** | .759** | .773** | .790** | .792** | .801** | .834** | .840** | .815** | .802** | .851** | .796** | .761** | .765** | 1 | | |
| ⑮ Help to understand the content of the course | .751** | .744** | .751** | .762** | .765** | .774** | .806** | .814** | .806** | .780** | .818** | .774** | .756** | .754** | .867** | 1 | |
| ⑯ Overall satisfaction | .213** | .189** | .194** | .189** | .186** | .187** | .210** | .212** | .199** | .195** | .211** | .205** | .202** | .200** | .220** | .229** | |
| ⑰ Lecture evaluation | .859** | .877** | .893** | .905** | .904** | .899** | .890** | .899** | .892** | .888** | .892** | .882** | .873** | .870** | .895** | .880** | 1 |

CIPP: context-input-process-product.
** $p < .01$.

the structure of factors 1 and 2 immediately before leveling in the data matrix is an appropriate model. All items were extracted as one component (factor), and the total cumulative explanatory variance was 79.417%, which was found to be suitable as a factor model. If it shows more than 60%, it is recognized as a suitable model. The Cronbach α value for 16 items conducted to check the degree of internal agreement was .984, which was found to be reliable.

After the screening test and review of the cumulative variance ratio, parallel line analysis was performed on the same data. In the parallel line analysis result, the eigenvalues obtained from both the sample and the wireless data were compared, and the number of eigenvalues showing a larger value in the sample data than in the wireless data is determined as the number of factors. In the case of the eigenvalue (12.917) derived from the actual data was higher than the eigenvalue (3.542) derived from the wireless data. However, from the case involving two factors, the eigenvalue (3.542) of the wireless data was higher than the eigenvalue (1.879) obtained from the actual data. In parallel line analysis, one factor was judged as the optimal factor because the upper limit of the number of factors was judged as the optimal number of factors within the range in which the eigenvalue of the actual data is larger than that of the wireless data. The components extracted by the maximum likelihood extraction method were found to be between .861 and .910 (Table 5).

**Table 5.** Initial components of lecture evaluation tools

| CIPP | Items | Initial components |
|---|---|---|
| Input | Webex leverage | .861 |
| Input | Pre-class information | .881 |
| Input | Class environment information provided in advance | .900 |
| Input | Presenting a specific lesson plan | .908 |
| Process | Class proceeds according to the syllabus | .910 |
| Process | Present class goals for each class | .908 |
| Process | Appropriateness of online class materials | .892 |
| Process | Class method appropriateness | .903 |
| Process | Efforts to interact with students | .897 |
| Process | Quick response to inquiries | .888 |
| Process | Summary of the main contents of the class | .898 |
| Product | Help to understand the content of the course | .898 |
| Product | Overall satisfaction | .876 |
| Context | Fidelity of evaluation contents | .893 |
| Context | Clarity of evaluation criteria | .869 |
| Context | Appropriate evaluation method | .874 |

CIPP: context-input-process-product.

The validity and reliability of the items by academic discipline were similar to the results extracted for all subjects regardless of academic discipline. The commonality of all items was higher than .60, indicating that all of them were important factors, and as a result of extracting the factors for each academic discipline, one factor was found, the range of factor loading was higher than .60, and the explanatory power was 75% or more (Table 6).

*Effect of learning evaluation tools on learning evaluation scores*

To investigate the effect of learning evaluation tools on learning evaluation scores, multiple regression analysis was performed using the learning evaluation tools as independent variables, learning evaluation score items as dependent variables, and demographic variables as control variables. As shown in Model 1, the educational background control variable was found to affect the learning evaluation score. In Model 2, it was found that the control variables, academic background, and learning evaluation tools, had a significant positive effect on the learning evaluation score. The regression model shows $F = 380409.843$ ($p < .01$), and $R^2 = .997$ for the regression equation, showing 99.7% of explanatory power. The condition that the tolerance limit of multicollinearity should be greater than or equal to .1 and the coefficient of variance expansion (VIF) should be less than or equal to 10 was satisfied (Table 7).

## DISCUSSION AND IMPLICATION

As COVID-19 persists, many universities have switched to online classes. We are working to maintain the quality of lectures during to the transition to and continuation of online classes that are unfamiliar to both teachers and students. Accordingly, this study was intended to provide basic data for improving the quality of online classes and to contribute to strengthening teaching competency by developing learning evaluation tools that reflect the characteristics of online classes. A discussion of the results derived from this study is as follows.

First, it was confirmed that the CIPP evaluation model developed by Stufflebeam (2004) is suitable for developing learning evaluation tools for online classes. CIPP is an evaluation model developed and developed by Stufflebeam. Compared to the existing evaluation model, the CIPP evaluation model can cover a wider range of subjects as evaluation targets, and it is possible to evaluate various components of the program, and it is characterized by a systematic approach from decision-making to evaluation. The context evaluation of the CIPP evaluation model helps to establish the purpose of developing the class evaluation tool at the beginning stage. It helps to evaluate the purpose of class evaluation established after the completion of the development of the evaluation tool for online classes. Input evaluation is useful for developing or

**Table 6.** Commonality of Lecture Evaluation tools by Academic Discipline

| CIPP factor | Items | Humanities and Social Sciences | Natural Science | Engineering | Arts and Physical Education |
|---|---|---|---|---|---|
| Input | Webex leverage | .841 | .881 | .867 | .876 |
| Input | Pre-class information | .875 | .89 | .887 | .879 |
| Input | Class environment information provided in advance | .891 | .911 | .897 | .903 |
| Input | Presenting a specific lesson plan | .904 | .911 | .917 | .908 |
| Process | Class proceeds according to the syllabus | .905 | .912 | .915 | .914 |
| Process | Present class goals for each class | .902 | .916 | .907 | .908 |
| Process | Appropriateness of online class materials | .879 | .901 | .883 | .912 |
| Process | Class method appropriateness | .891 | .914 | .894 | .915 |
| Process | Efforts to interact with students | .893 | .898 | .902 | .899 |
| Process | Quick response to inquiries | .888 | .884 | .882 | .895 |
| Process | Summary of the main contents of the class | .888 | .912 | .884 | .905 |
| Product | Help to understand the content of the course | .887 | .912 | .876 | .910 |
| Product | Overall satisfaction | .866 | .888 | .869 | .879 |
| Context | Fidelity of evaluation contents | .889 | .889 | .907 | .904 |
| Context | Clarity of evaluation criteria | .870 | .871 | .852 | .871 |
| Context | Appropriate evaluation method | .869 | .887 | .831 | .884 |
| Distributed explanatory power (%) | | 78.117 | 8.77 | 78.465 | 8.593 |

CIPP: context-input-process-product.

**Table 7.** Results of regression analysis between lecture evaluation tools and lecture evaluation scores

| Independent variable | Model 1(control variable) | | | | Model 2(independent variable) | | | |
|---|---|---|---|---|---|---|---|---|
| | B | SE | β | t | B | SE | β | t |
| (Constant) | 90.536 | .475 | | 190.58 | -.397 | .046 | | -8.653 |
| Grade | -.631 | .088 | -.050 | -7.163** | .014 | .005 | .001 | 2.759** |
| Webex leverage | | | | | 1.351 | .013 | .079 | 102.230** |
| Pre-class information | | | | | 1.239 | .016 | .067 | 78.140** |
| Class environment information provided in advance | | | | | 1.137 | .018 | .06 | 64.067** |
| Presenting a specific lesson plan | | | | | 1.293 | .019 | .068 | 69.404** |
| Class proceeds according to the syllabus | | | | | 1.27 | .019 | .066 | 66.818** |
| Present class goals for each class | | | | | 1.245 | .017 | .067 | 71.211** |
| Appropriateness of online class materials | | | | | 1.729 | .015 | .100 | 115.951** |
| Class method appropriateness | | | | | 1.653 | .016 | .096 | 103.524** |
| Efforts to interact with students | | | | | 1.566 | .016 | .089 | 98.101** |
| Quick response to inquiries | | | | | 1.414 | .016 | .079 | 90.035** |
| Summary of the main contents of the class | | | | | 1.931 | .015 | .111 | 127.759** |
| Help to understand the content of the course | | | | | 1.284 | .017 | .075 | 75.810** |
| Overall satisfaction | | | | | 1.442 | .014 | .089 | 99.835** |
| Fidelity of evaluation contents | | | | | 1.502 | .017 | .078 | 88.315** |
| Clarity of evaluation criteria | | | | | 1.376 | .017 | .075 | 82.494** |
| Appropriate evaluation method | | | | | 1.364 | .017 | .074 | 82.210** |
| $R^2$(.adj $R^2$) | .007(0.006) | | | | 0.997 | | | |
| $\Delta R^2$($p$) | .007 | | | | .990 | | | |
| F($p$) | 46.542 ($p$=.001) | | | | 380409.843 ($p$=.000) | | | |

Control variables are treated as dummy variables
**$p$ < .01, Dubbin-Watson=1.941.

evaluating the tools. Process evaluation helps to identify differences and problems between the situation shown in the course of the classes and the intended situation. Product evaluation collects and allows for judgment about a wide range of information related to the achievement of goals, thus helping to make decisions about improving class evaluation. The reason why the CIPP evaluation model was used in this study is that it has the advantage of being able to be used to evaluate any stage in the course of class implementation.

Second, 1 factor and 16 items were derived for learning evaluation of online classes through the analysis of previous studies on learning evaluation tools and previous studies related to online classes at universities due to COVID-19. By the procedures of class preparation, class operation, class product, and learning evaluation, the main items of learning evaluation were derived. Specifically, the input evaluation consisted of four items, including 'ability to use Webex', 'pre-class guide', 'preparation of class environment information', and 'presentation of a specific lesson plan'. The process evaluation consists of 7 items: 'Proceeding according to the syllabus', 'Suggesting class goals for each class', 'Appropriateness of online class materials', 'Appropriateness of class method', 'Efforts to interact with students', 'quick response about questions ' and 'organization of the core contents of the class' were included. The product evaluation consisted of two items, including 'help in understanding subject content' and 'overall satisfaction'. Finally, the Context evaluation included three items, 'fidelity of evaluation content', 'clarity of evaluation criteria', and 'appropriateness of evaluation method'.

Third, whereas the previous offline classes evaluation questions of universities were composed mainly of the teacher's class behavior, the revised tools were structured to reflect students studying independently. For example, learning support, that is, providing an environment for video classes, platform operation ability such as Webex, preparing materials for a video class, providing a class guide by week, and evaluation criteria, contents, and methods suitable for video classes are included.

Fourth, validation of the learning evaluation tools for online classes at universities was conducted based on the mid-term and final learning evaluation tools used for online subjects offered in the second semester of the 2021 academic year. As a result of exploratory factor analysis, it was found that 16 learning evaluation items were grouped into one factor in the scree test and cumulative vari-

ance ratio. It could be judged that all the items for each CIPP factor fully incorporated online learning events in universities. In this study, the fact that learning evaluation tools in online classes were not subdivided into different factors according to the classes procedure or teacher's behavior but appeared as one factor was linked to classes preparation, classes operation, classes assignments, and notebook evaluation in university online classes. This means that they are performed simultaneously; all CIPP factors should be considered together for quality control of online classes.

Fifth, the learning evaluation factors and items for online classes at universities presented in this study provide basic data for systematic teaching method development or teaching support to enhance classes satisfaction. You will be able to understand the difficulties faced by educators and students in online classes and ways to provide support.

This study explored learning and teaching factors that can be used to develop learning evaluation tools for online classes at universities and then verified the validity of the items through expert content analysis and exploratory factor analysis. Suggestions for future research are as follows. First, it is necessary to develop learning evaluation tools by including a series of processes such as determining convergent validity, criterion validity, and construct validity. Second, various learning evaluation methods should be reviewed. It is necessary to include use a mobile platform in consideration of the characteristics of students who are the smart generation as well as the online method implemented by most universities. In addition, various descriptive items should be developed to evaluate lectures quantitatively as well as qualitatively so that they can be referred to for lecture improvement.

While this study provides exploratory level result, it provides basic data for developing and validating learning evaluation tools for various online classes by reflecting the future academic disciplines and teaching methods such as theory, practical skills, practice, and experiments.

## CONFLICT OF INTEREST

The authors declared no conflict of interest.

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# Intensive Innovation Experience: Which Skills Can Be Activated Using A Short-Term PBL Project?

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**Purpose:** Through this study, the researchers aimed to determine which skills were developed during a short-term project PBL-like event named Expin-48.
**Methods:** A descriptive evaluative study involving participant observation, questionnaires and focus groups enabled comparisons between observations of mentors and the perceptions of students on the nature of skill development in a short-term problem-oriented project.
**Results:** Leadership and teamwork were the skills which stood out as critical for success in collaborative student-centered projects.
**Conclusion:** PBL in the form of short-term project can work as an efficient educative learning event. Activation of essential skills required for engineering projects was evident in the learning process and outcomes.

**Keywords:** Educational hackathon; Innovation; Project problem-based learning; Skills; STEAM

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## INTRODUCTION

### PBL and short-term projects

Creative sectors in the economy have been using strategies to entice people to come up with innovative ideas. A Hackathon is one of those strategies deployed as a platform that develops short-term projects (STP). Hackathons are projects that last less than 48 hours, aiming to encourage teams to develop creative solutions to real problems and deliver innovative products at the end. All necessary steps for the development of a project can be covered, even in a short time. Designed by IT companies, Hackathons aim to develop software and apps quickly. Later, investors used this model to identify new ideas for the market and support start-ups to create new products. The name hackathon combines two words: Hacker, the program developer, and Marathon, long-distance race symbolizing endurance and tenacity pursuing a goal. Nowadays, creative companies and industries incorporate this methodology; they regard innovation as a critical element for survival in the information society dynamics of competition and the rapid obsolescence of products.

Hackathons are educational tools that prepare students for future jobs given through experiences that elicit their creativity during such processes. Educational hackathons can be a subgroup of Project Problem-Based Learning (PBL) (Braga et al., 2021).

These short-term projects may pose a challenge for educators. The first question is whether the fundamentals of PBL concepts can provide consistent support for these new platforms. PBL is a methodology using real-world problems to students to activate their skills through project development (Graaf & Kolmos, 2007; Kokotsaki et al., 2016).

## Objectives

This descriptive evaluative study aimed to compare researchers' observations with the students' perceptions about skills developed during a hackathon-type event called Expin48. The questions were:

- Which skills in this short-term PBL did the participants use?
- Were there any new skills?
- Which skills need development?
- Which skills influenced the success or the failure of the project?

## Theoretical Framework

Nowadays, professionals need to have a multidisciplinary set of skills to maintain employability (Lemaitre, 2006). Some authors defend the idea of learning based on hands-on practise to gain experience and understanding to develop problem-solving skills. Through projects, students perform tasks and walk through the cycles of conceiving, designing, and implementing (Edström & Kolmos, 2014). While understanding-based learning requires an examination of technical objects, processes, systems, and the production of scientific and mathematical references, action-based learning enables application as knowledge becomes contextualized. Therefore, it is necessary that understanding-based learning and hands-on practice be complementary for developing problem-solving skills (Pittich, 2020).

In education, the combination of understanding-based learning together with hands-on practice is referred to as experiential knowledge based on hands-on activity and not solely relying on theoretical academic understanding. Thus, these educational concepts change the definition of knowledge acquisition to development of competence (Lemaitre, 2006).

Professionals need to integrate different skills to identify and solve complex problems of the current world regardless of the competence classification.

There are different points of view on how to determine which competence is the most important for today's world. For example, given the internationalization of society and commerce, students need to prepare to work in a global community, requiring preparation for practice in various contexts. Thus, language and communication skills are essential for those who will live in international environments. Likewise, diversified interpersonal skills, considering cultural and ethnic diversity, are crucial, including fostering creativity, since a diverse team has a better chance of recognizing opportunities (Lohmann, 2006). In 2014, the OECD had already pointed out that, among others, cooperation is a component that positively influences student performance at school and beyond, being as important as cognitive skills (OECD, 2014).

Although Lévy created "collective intelligence" in cyberspace, it is possible to use it in 'face space'. The collective intelligence to individual skills and competencies coordinated in networks that favor the collectivity (Lévy, 1994). The networks are a way through which information is built and shared. However, for this to occur, it is necessary to identify each one's knowledge that can be considered valuable for developing a given project, that is, identifying individual competencies that can provide mutual enrichment. In this way, knowledge acquisition is collaborative, forming collective intelligence. In addition, members will associate competencies with teamwork and communities, since through the social relations established in the group and the sharing of its members, they can manifest a collective competence—the competence created is more than the simple sum of individual competencies (Le Boterf, 1999).

The competence of innovation is central to the 21st-century engineer. However, this competence is complex, encompassing a set of others, such as creativity and leadership, which can act separately or overlap (Ovbiagbonhia, 2020). Studies show that companies struggle in developing innovative projects, mainly due to a lack of understanding of development processes (Millet et al., 2016). Schools need to develop in students the concept of innovative projects and assist with developing their inventive capacity. Among the key competencies required to address the needs of today's world, we can highlight leadership, teamwork, and creativity. Several authors describe the importance of leadership in the success of projects (Novo et al., 2017).Burke (2006) believes that, without dynamic leadership, design teams would move without a defined direction, like a boat without a rudder. Educators can also define leadership as the process of an individual influencing a team to achieve a specific goal (Gebczynska, 2019) successfully.

Amidst the variety of definitions, it is possible to identify a common element, the interaction with others aiming to accomplish an objective. Another common aspect of leadership among researchers is that leaders play a vital role in the success of projects. Thus, the lack of leadership or the lack of leadership skills may be directly associated with the failure of a project (Gadirajurrett et al., 2018). A meta-analysis study identified a correlation between leadership and project success. However, it is not a strong correlation because of various leadership styles (Damayanti et al., 2018).

Leadership by itself does not guarantee the success of a project. Teamwork is also essential. Team members work interdependently and adaptively on a common task, sharing responsibility for the results (Tarricone & Luca, 2002; Sanyal & Hissam, 2018). Therefore, a project can focus on a standard task. Teamwork can improve team members' performance rather than members working on the same job individually; team members skills become complementary when working as a team; this enhances their strengths

while minimizing individual competence gaps. Other advantages of teamwork are sharing of workload, a boost in members' self-confidence, and promoting a creative work environment through an exciting, satisfying, and pleasant experience (Sharma, 2012). Teamwork can also foster team members skills development through exchanging opinions, experiences, and points of view. Studies have shown that teamwork is efficient, especially in situations that require creative resolution. Teamwork efficiency is related to the existence of common goals, establishing and understanding of individual roles by each team member and the general perception of participation in decision-making.

**Developing Skills**

Knowledge by itself is not enough to provide sound solutions to challenging problems. Instead, it is necessary to focus on deploying knowledge to generate new ideas, concepts, and artifacts, for problem-solving. Therefore, it is essential to include several hands-on and problem-solving skills in curricula as a priority.

The current teaching model is, however, often centered on the teacher. In this model, students are used to being passive recipients of information; Freire called this the "The banking concept of education" (Freire, 1996). According to Piaget (Piaget, 1971), students need to act and reflect on their actions to learn. The development of competence in reflection allows them to learn how to learn. A solution to the problems of traditional education is the use of more active methodologies.

PBL is an alternative option to the current model. After the teacher provides a broad theme through this methodology, students are organized in small teams and are encouraged to provide possible solutions through prototyping and elaboration. Students observe their community environment and identify problems related to that topic presented by the teacher. A learning stage Freire (Freire, 1996) referred to as "reality reading"; in the project's development, the teacher acts as a mediator and mentor, promoting teamwork and motivating interdisciplinary learning. Thus, students have incentives to learn and develop essential skills for current world problems (Graaf & Kolmos, 2007; Kokotsaki, Menzies & Wiggins, 2016).

Students have different backgrounds and prior knowledge, intelligence levels, skills, and competencies. Supervision by a mentor is essential to assemble teams with complementary competencies and skills and determine a common goal for the team members of each group. Mentor supervision also plays a role in recognizing learning cycles. During those cycles, team members notice what they need to learn to reach their goals. Knowledge is constructed collectively through the exchange between peers, practical activities, analysis, debates, and questions (Matthews et al., 2010). This collaborative experience is essential to obtain competencies and develop skills that can be invaluable qualities in future work environments (Hallinger & Bridges, 2016). PBL adds a variety of essential skills to future professionals (Lehmann et al., 2008), in addition to increasing students' interest in STEAM education (Blinkstein et al., 2017) and curiosity for the STEAM careers (Maiorca et al., 2021). Having recognized the importance of particular skills, the use of active methodologies of the STEAM type may assist in preparing students for working in teams, exercising leadership, and identifying leadership. In addition, this approach highlights the value of the idea of holding events in schools where students can develop socio-emotional, technological, and entrepreneurial skills.

Developing skills relies on incentivizing students to hypothesize, question, seek information, cooperate with the team, make decisions according to the information collected and, if necessary, reevaluate their initial points of view. In other words, there must be aware of the need to "learn to learn" (Saliceti, 2015). We consider these skills as paramount to teamwork and productivity. Furthermore, such skills are considered critical nowadays to employability. We intend to provide some evidence to the scientific and academic communities, a better understanding of students' contribution in their collaborative, dynamic learning situations; schools can deploy tools to access and measure the development of students' skills and competencies.

**Expin48 (Experience in Projects of Innovation – 48hours)**

Expin48 is a short-term PBL event developed by the Centre for Technological Education of Rio de Janeiro (CEFET/RJ) in Brazil. CEFET/RJ is an educational institution that differs from the traditional technology universities because it accommodates three academic levels; the Technological High School (THS), which prepares technicians in several areas of engineering, the Engineering undergraduate courses, and the Engineering graduate school. Expin48 is the first experience that includes students from those three educational levels to work together during the event for innovative solutions for real-world problems.

Expin48 is not part of the curriculum and is not related to any particular discipline, nor is it committed to summative assessment. Participation in Expin48 is voluntary, we assembled a selection of 30 students with the intent to have at least one student from each level in each team. A week before Expin48 begins, the event organizers present themes as part of that Expin48 edition. Throughout that week, students can elect at least three themes. Each team is composed of six students, gathered according to their thematic preference. Each team must choose a different theme. Assembling teams is a complex process that requires nego-

tiation.

The event has four brief stages: a) Interaction - Students select themes and interact with each other forming teams; b) Design - The team should define a problem and present three possible solutions for mentors who have the mission to help them to choose the best one; c) Prototyping - The team develops a prototype for the chosen solution; d) Presentation - The team should prepare three kinds of presentations for the judges: Video ("Elevator Pitch" in 90 seconds), a white paper (a brief technical description), and a conference presentation.

During the first hour, students interact to assemble their teams. After that, they have three hours to elect three real-world problems and brainstorm a possible solution for each. At the first meeting with the mentors, all teams should present their ideas as problems and their solutions. During this meeting, they discuss with mentors the viability of their ideas. Then, they must choose which will be carried out (Clark & Wheelwright, 1992). Each stage has a deliverable established. It is crucial to maintain smaller goals throughout the process, preventing students from mismanaging their time. At the end of each step, there are meetings with mentors where they should present and check the project's status (Cooper, 1993). Then, each team presented the final product to a committee composed of six members from private companies and universities. The six members are part of the event Board which awards the winning team, and four other categories: technical quality, feasibility, innovation, and presentation.

# METHODS

The first edition of Expin48 took place in October 2019, where proposals included global themes on cities of high-density populations: Topics for that edition covered urban mobility, waste processing, and senior life. In addition, specific themes focused on the reality of issues in developing countries such as floods, landslides, and disease.

Students named their teams, but they are de-identified as A, B, C, D, and E in this study.

We invited all 30 students to participate: 15 from technical high school (THS), ten from undergraduate and five from the graduate school. Out of the total, 19 students answered the questionnaire anonymously. However, it is not possible to determine the academic level of those who contributed. Team representation involved four students from each except Team E with three; we can infer that this represented all academic levels. Active observation by the researchers and focus groups centered on all students.

This study was submitted to the Oswaldo Cruz Foundation's Human Research Ethics Committee, Oswaldo Cruz Foundation, Rio de Janeiro, Brazil, and approved under the number 48109321.3.0000.5248.

**Data Collection and Analysis**

Evaluative data was collected using a triangulation of three different methodologies, all performed with student authorization.

*1. Participant observation*

The researchers participated as mentors, making it possible to study the students' behavior during all stages of the event.

That observation enabled elaboration through a questionnaire to clarify some factors observed.

*2. Questionnaire*

Event participants responded to a questionnaire using open-ended and closed questions and a "Google Forms" platform, anonymously, individually, and voluntarily. The researchers formulated the questions to assess competence parameters within three categories, each divided into items: personal skills - curiosity, initiative, persistence, knowledge, flexibility, creativity, written communication, verbal communication; process skills - leadership, teamwork, organization, planning, operationalization of expertise, objectivity; technological skills - technological knowledge (tools).

The results were analyzed using a scale, where a score of one represents an unsatisfactory opinion for that item analyzed, two regulars, three indifferent, four good and five excellent. In addition, the questions were designed to score in a binary way, offered options of either one or five, minimizing the risks of subjective interpretations. To determine team scores, individual responses were considered, and calculations involved the simple average of individual responses. Thus, the intermediate grades were the result of these averages. Likewise, for the overall result, the average of the team's scores was used.

From the scores, maturity models adapted from Fisher (Fisher, 2004) were created, using the same scoring scale, where each item represents a vertex of the graph. To calculate the degree of maturation of each dimension, we assumed one as a weight for each of them because we understand that all are equally important for estimating the element. For data interpretation, we used an approach like that used by Senra & Braga (2020).

*3. Focus group*

A focus group session with Teams A (did not win in any category) and B (overall winner) enabled the researchers to address inconsistencies and ask clarifying questions. It was not necessary to interview other students.

## RESULTS

After the event ended, we evaluated the projects using an "ad hoc" panel comprised of academy members and innovative companies. The examining Board chose the winning team and awards in the following categories: Technical quality, feasibility, innovation, and presentation. Team B was the winner of the general category and technical quality winner, team C in the feasibility category, D in innovation, and E in the presentation. Team A did not receive an award in any category. Thus, we compared Team A with B to find differences that justify the failure and success of these teams based on their skills and competencies. We did take into consideration our observations related to the other teams.

In general, the members of the teams knew each other, except Team C, that was entirely randomly created. This information is relevant for assessing the synergies created between the components during teamwork. On the other hand, several of the participants of the other teams knew each other, as they mostly declared themselves as classmates, boyfriends, schoolmates. This familiarity can also reflect the moment of enlisting for the event when one encourages others to participate. However, when asked how they got together in teams, the majority (14 students) answered the criterion was associated with the theme.

Researchers evaluated questionnaire items according to the criteria described in the previous section, and the results were expressed in the form of a maturity model. According to this model, the "Competencies" element has 15 dimensions:

Curiosity, initiative, persistence, knowledge, flexibility, creativity, written communication, verbal communication, leadership, teamwork, organization, planning, operationalization of knowledge, objectivity, and technological knowledge. Figure 1 shows the results.

It is essential to highlight that the notes on the responses to the questionnaires represent the averages of each student's perceptions of each element. However, our participant observation allowed further analysis, generating a new set of scores, as shown in Figure 2.

According to the self-assessment of team members, all teams have a reasonable degree of maturity in two elements, with an average of four. Only the leadership element had scores considered insufficient or regular in all teams. The skills with the highest scores were written communication, flexibility, teamwork, organization, operationalization of knowledge, and verbal communication, while the leadership scores were the worse. However, our observations show that there was clear leadership in at least two teams.

Team C members were not only unknown to each other but seemed not to have empathy for the theme. Thus, work began in a discouraging way and was refractory to the ideas of colleagues. However, along the way, a graduate student assumed the role of

| DIMENSIONS | TEAMS | | | | | TEAMS AVERAGE |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | |
| CREATIVITY | 4 | 4 | 4 | 3 | 5 | 4 |
| KNOWLEDGE | 4 | 4 | 3 | 3 | 4 | 3 |
| WRITTEN COMMUNICATION | 4 | 4 | 4 | 4 | 5 | 4 |
| LIDERSHIP | 1 | 1 | 1 | 2 | 2 | 1 |
| INITIATIVE | 4 | 4 | 3 | 3 | 3 | 3 |
| FLEXIBILITY | 4 | 5 | 4 | 4 | 4 | 4 |
| CURIOSITY | 4 | 4 | 3 | 4 | 3 | 4 |
| PLANNNING | 4 | 4 | 3 | 4 | 3 | 3 |
| TEAMWORK | 4 | 4 | 4 | 4 | 4 | 4 |
| OBJECTIVITY | 4 | 4 | 3 | 4 | 5 | 4 |
| ORGANIZATION | 4 | 4 | 4 | 5 | 4 | 4 |
| OPERATING KNOWLEDGE | 4 | 4 | 4 | 4 | 5 | 4 |
| PERSISTENCE | 3 | 3 | 4 | 4 | 3 | 3 |
| VERBAL COMMUNICATION | 4 | 5 | 4 | 4 | 4 | 4 |
| TECHNOLOGICAL KNOWLEDGE | 3 | 4 | 4 | 3 | 4 | 4 |
| TEAM AVERAGE | 3,6 | 3,8 | 3,85 | 3,6 | 3,8 | 3,53 |

**Figure 1.** The Degree of maturity of the elements of competences, according to students' self-assessment.

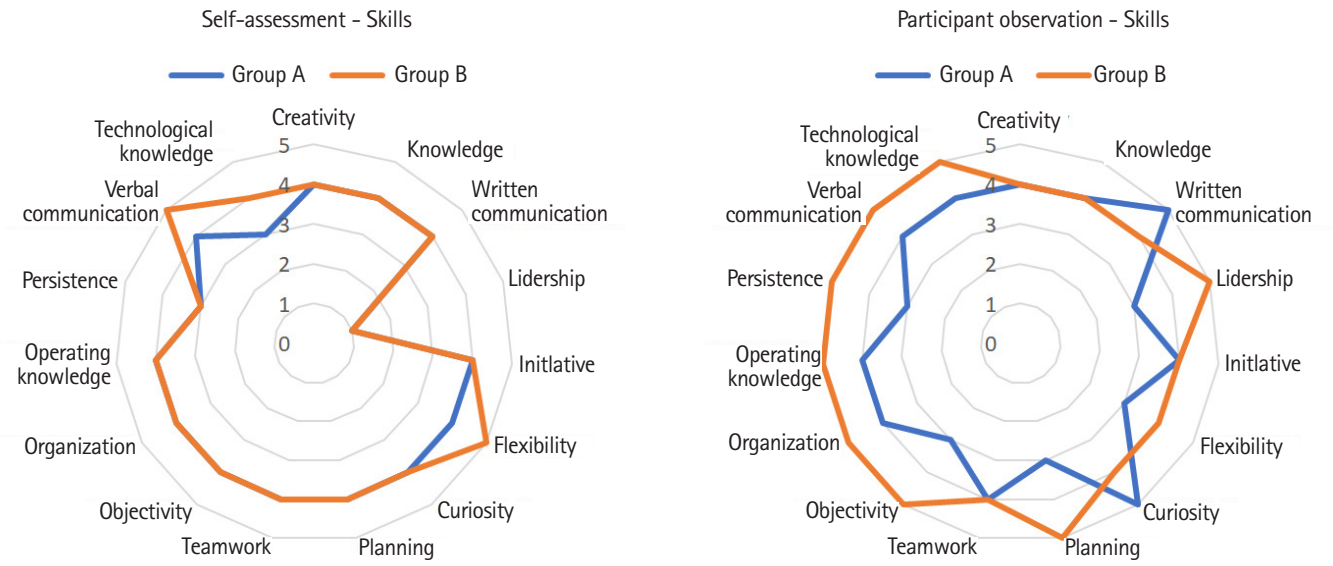


**Figure 2.** The Degree of maturity of the elements of competences, according to the participant observation.

leader, managing not only to stimulate his colleagues but also to direct the work. Since he did not do this explicitly, the other members did not realize they were being led. Perhaps this is the reason they did not assume that there was leadership in their team. In a different way, in Team B, a graduate student clearly assumed the leadership role, determining the next steps to be taken and defining what was important. Team E worked erratically during the process, with rough discussions and members not giving up their opinions. From several interventions from the mentors, on the second day of the event, the team was able to find a course to proceed, still with no apparent leadership.

Perhaps due to the leadership exercised by a student in Team B, who highly organized the group, they had a strict division of labor, where each member was assigned a task to which she had better knowledge to perform it. The THS students of this team were not intimidated by their academically superior colleagues and performed complex functions, such as computer modelling, video editing, and prototyping. Team D also performed their tasks smoothly, on time, and without apparent tension. Members worked to develop their tasks, always presenting their productions to each other, reaching consensus. As previously reported, both Teams C and E worked most of the time in a disorganized, chaotic manner. However, from the second afternoon on, they achieved a level of organization that allowed the realization of a final product.

Some teams made a regular self-assessment of the items related to knowledge, initiative, planning, and persistence, and the researchers' observation was not so negative. The teams had good knowledge, worked according to a plan, had the initiative to act, and were persistent in searching for results. However, according to our observations, Team A showed a lack of planning and persistence during the process.

When analyzing this data in a graph, it is possible to verify that the dimensions are represented very similarly in all teams. Interestingly, when we superimpose the graph of the competence element of Teams A (lowest place in the event) and B (highest place in the event), it is impossible to identify significant differences. However, when we compare the data from our observation with those obtained through self-assessment, differences arise, showing that the winning team was superior in the dimensions of the studied skills (Figure 3).

When we compared the winning Team B chart with other teams, we noticed it stands out in all items and obtained lower scores in some, both by self-assessment and participant observation (Figure 4).

Through a self-analysis of the characteristics of their teams, the members were invited to score different aspects, one represents less important, and nine is most important. We observed that all teams, self-qualified with high scores for reasonable features such as friendship, interaction, and organization. While Team A scored itself highly on untimely features such as disorganization, not listening to each other, lack of focus, and competitiveness, they give low scores for opportune features such as friendship, knowledge, interaction, and organization (Figure 5).

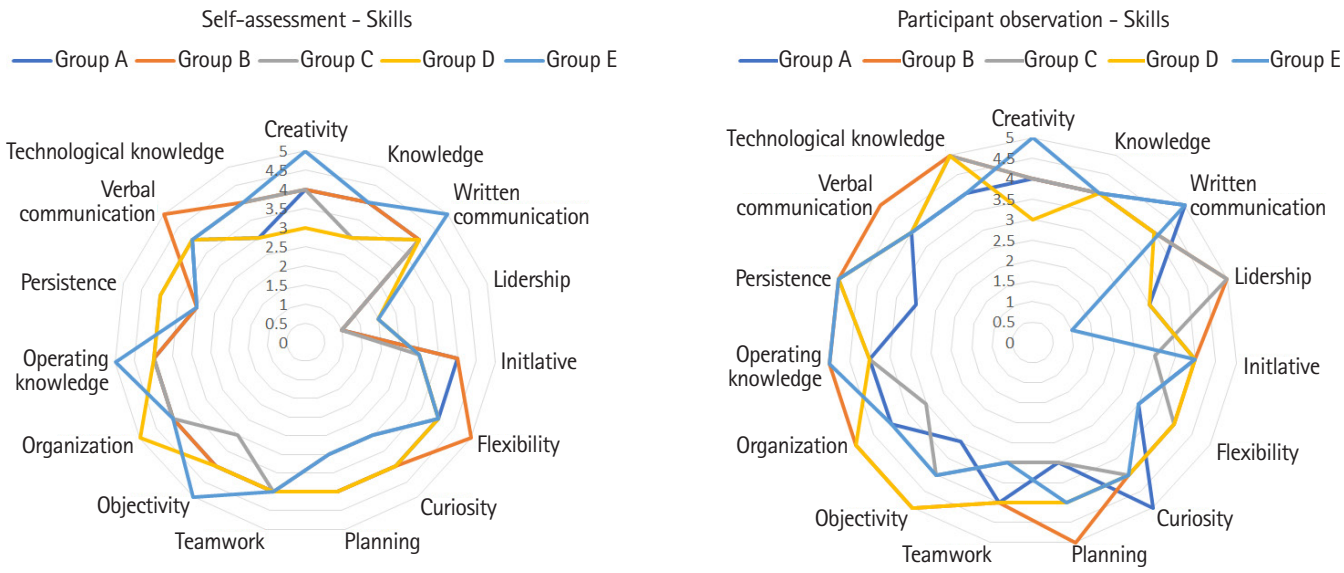


**Figure 3.** Compering the two grades obtained from students' self-assessment and participant observations.

| DIMENSIONS | TEAMS | | | | | TEAMS AVERAGE |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | |
| CREATIVITY | 4 | 4 | 4 | 3 | 5 | 4 |
| KNOWLEDGE | 4 | 4 | 4 | 4 | 4 | 4 |
| WRITTEN COMMUNICATION | 5 | 4 | 4 | 4 | 5 | 4 |
| LIDERSHIP | 3 | 5 | 5 | 3 | 1 | 3 |
| INITIATIVE | 4 | 4 | 3 | 4 | 4 | 4 |
| FLEXIBILITY | 3 | 4 | 4 | 4 | 3 | 4 |
| CURIOSITY | 5 | 4 | 4 | 4 | 4 | 4 |
| PLANNNING | 3 | 5 | 3 | 4 | 4 | 4 |
| TEAMWORK | 4 | 4 | 3 | 4 | 3 | 4 |
| OBJECTIVITY | 3 | 5 | 4 | 5 | 4 | 4 |
| ORGANIZATION | 4 | 5 | 3 | 5 | 4 | 4 |
| OPERATING KNOWLEDGE | 4 | 5 | 4 | 4 | 5 | 4 |
| PERSISTENCE | 3 | 5 | 5 | 5 | 5 | 5 |
| VERBAL COMMUNICATION | 4 | 5 | 4 | 4 | 4 | 4 |
| TECHNOLOGICAL KNOWLEDGE | 4 | 5 | 5 | 5 | 4 | 5 |
| TEAM AVERAGE | 3,8 | 4,5 | 3,9 | 4,1 | 3,9 | 4 |

**Figure 4.** Comparison of the degree of maturity of each dimension of the competencies of all teams, based on the students' self-assessment and participant observation.

## DISCUSSION

The triangulation of the methods of capturing the information allowed for the removal of minor inconsistencies, guaranteeing significant credibility in the answers given by the students to the questionnaire. Therefore, when comparing the responses obtained by the self-assessment with the field observations, it was possible to compare. Furthermore, when we used the interview to clarify some doubts, the need for this approach became evident since, through questionnaires and participant observation, some participants' behaviors did not match.

When we analyze the leadership element, there is a substantial

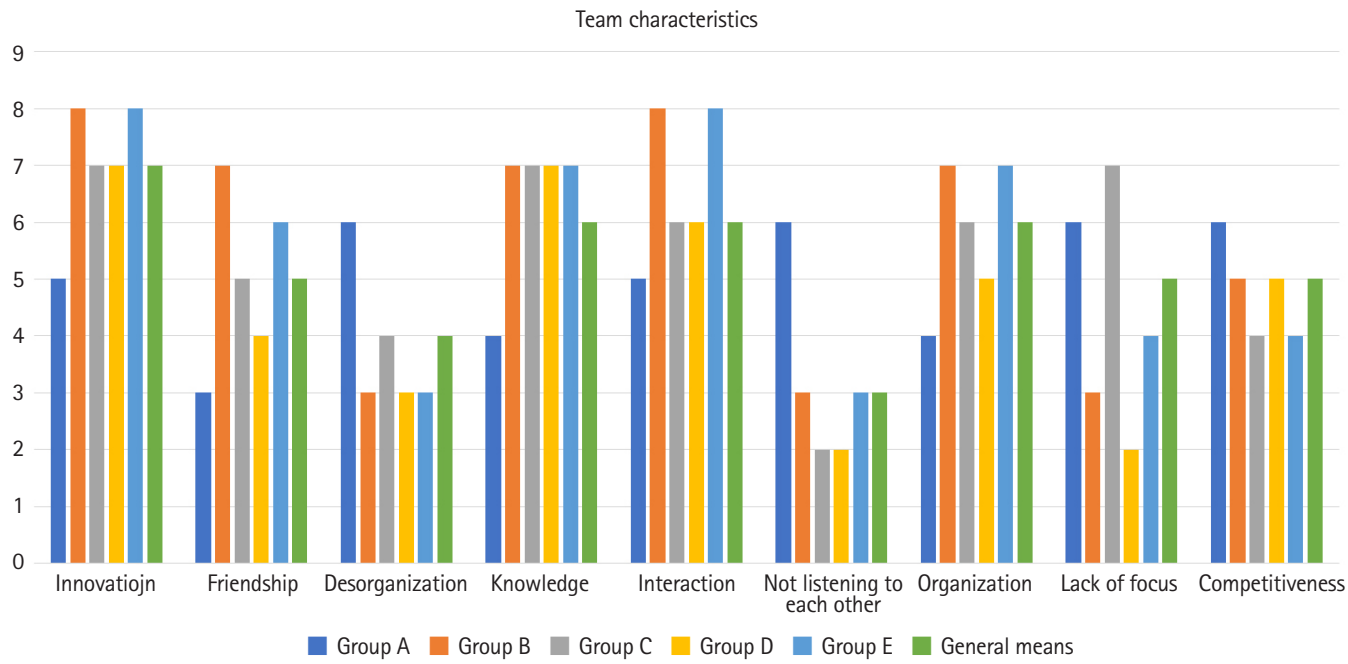


**Figure 5.** Characteristics of each team. Higher score represents greater relevance of the characteristic, according to the self-assessment of the team members.

discrepancy between the responses to the questionnaire -the result of students' self-assessment - and the field observation. According to the majority of participants, there was no leadership in their teams during the event. As the questionnaire was designed to evaluate the elements from their answers to several different questions, it was possible to observe that the teams discussed each moment of the project elaboration and thus ruled out the possibility of leadership. In the students' conception, leadership is seen as a perjorative term and therefore cannot be related to their team. Furthermore, there is a natural confusion between the two words leadership and boss.

The results demonstrate the importance of this competence for successful project development. Leadership is closely related to teamwork. The leader motivates the team to walk ahead, promotes a cooperative environment, and inspires trust, encouraging collaboration and innovation (Anantatmula, 2010). Although the participants did not admit it, there was leadership in the teams that developed projects of technical quality. Some seemed to be unable to find a way, like Teams C and E, but thanks to the role of a leader, even discreetly, they found their path successfully.

On the other hand, one emotional disruption in Team A was produced by divergencies. This fact reduced cooperation between the members, leading them to perform below their capabilities. As a result, Team A failed to build leadership that sought balance at that time.

Since the 1980s, personal relationships between students have been a point of discussion. Johnson (1981) points out that student-student relationships can be more critical than student-teacher, as long as they are based on acceptance and supported by all the teammates. For him, during interaction through cooperative tasks, divergences or controversies are inevitable, and these conflicts can be constructive in promoting the performance and development of students. More recently, Wanders and collaborators (2020) state that the better the relationship between students, the more likely they are to feel safe and willing to participate and express their opinions. Unfortunately, this concept of better collaboration between friendly members did not seem to positively influence Team A's results as there was a misunderstanding between the team members. On the other hand, Team C shifted the behavior demonstrating a lack of initial interest, changed completely, and became united and competitive by the time of the final verdict. The leadership by a member of the team prompted this shift.

When analyzing the applied skills, the degree of maturity between the teams did not show significant differences, even between the winner team and the others. This outcome can be justified by the homogeneity of the teams formed by members of the same academic level from the same educational institution.

The highest degrees of maturity were those related to personal skills, such as written and oral communication and operationalization of knowledge. Other competencies, such as flexibility, teamwork, and organization, those related to processes, were also well

evaluated.

According to Servin and De Brun (2005), knowledge acquisition management needs to be supported on three pillars: people, processes, and technology, in a multidisciplinary view, with intentional and systematic coordination between the three (Dalkir, 2013). That is, diverse knowledge is necessary for understanding and dealing with problems. When we evaluated the teams according to field observation, technological knowledge also appears to be considered excellent with a degree of maturity. Thus, we verified that the teams achieved good positions in the three fundamental pillars.

When we analyzed the element of creativity, again, there were no significant differences in the degrees of maturity of Teams A and B. On the other hand, Team E had higher scores in the degrees of maturity analyzed through the two approaches. Despite having a conflicting relationship between its members at the beginning, this team managed to present an innovative and creative solution, based on process, different from the other teams that found their solutions based on products.

Thus, having the teams present similar degrees of maturity in all elements, we have some chances to explain the failure of Team A in the event. Communication is a crucial factor for good team performance, together with cohesion, here understood as the members' desire to remain in the team. Another significant factor is a collaboration between members (Tarricone & Luca, 2002). These factors were lacking in Team A when a member exacerbated competitiveness, reduced communication and collaboration, and decreased cohesion. In 2002, Tarricone and Luca described a situation where a team that developed an educational activity had to be undone because the members complained about members who did not contribute. This situation generated resentments, leading to serious disagreements, which even the team's mentor could not resolve. The interesting thing is that before the activity, the researchers informed the teams of the attributes necessary for the success of teamwork. However, a significant number of students realized the importance of teamwork for the project's success. Asking what skills and/or competencies they developed at the event, "teamwork" was most cited.

From the responses to the questionnaire, it is possible that this team had minimum requirements for success, such as interdisciplinary technical skills and other critical personal skills, such as creativity and knowledge (Iqbal et al., 2017). According to our analysis, this team obtained a degree of maturity similar to the others, including the winner team. In addition to the lack of adequate interpersonal skills, the team detected other deficiencies, such as disorganization and lack of focus.

According to our observations interview, it appears that this team has entered a negative spiral, with one problem leading to another. The lack of leadership led to them not working as a team; this consequently brought disorganization, here understood as a lack of task rationalization. Members developed an activity and, when looking for an alignment among them, they realized there was none; this led to demotivation, which considerably decreased communication between participants, increasingly feeding this snowball effect and leading the entire team to fail.

In general, we believe that the Expin48 event was a success. Many of the difficulties encountered, evidenced by degrees of maturity classified as regular, are mainly due to the limited time and lack of intimacy with the methodology. On the other hand, the idea of gaining knowledge and innovation were remarkable; this denotes the importance of the role of students in the search for knowledge, as proposed by the PBL methodology.

The participants acknowledged that there was a gain, skills and competencies with the experience. However, teamwork was the gain most cited by the participants. Therefore, knowing how to work as a team is a crucial strategy in today's job market. Hence the importance of developing it as soon as possible.

## CONCLUSIONS

The researchers sought to assess if specific competencies were essential for the successful development of an STP. No significant difference in the degree of maturity between the team that did not win any awards (Team A) with the winner (Team B) was observed. However, due to the triangulation of data capture methodologies, we realized that Team A did not obtain expressive leadership. Unlike other teams, they had difficulty working as a team and could not organize their path.

All teams, with no exception, recognized that teamwork was the primary competence needed to be acquired at the event. Unfortunately, Team A could not put this element of competence into practice, probably due to the lack of leadership. This outcome could have permitted the attitudes of one member to induce demotivation with a consequent loss of cohesion of the team.

We also suggest that leadership, teamwork, and organizations are key competencies for corporate jobs and educational settings, especially during project-based activities.

The researchers also verified that the PBL Expin48 event reached its goal; students were protagonists searching for the enrichment of knowledge, and they recognized their gain of skills and competencies with the experience. It was possible to notice that the participants did not distinguish the skills they already had from those they needed to develop. For example, although they recognized that organization, time pressure, and teamwork are

their most significant difficulties, this was attributed to the project model and not to their need to develop these skills. To minimize this misunderstanding, we suggest that participants meet with the mentors at the end of the event, where these issues are raised and discussed.

Although the study contributed to the literature in this field, the researchers are aware that there are limitations. Given the sample size and participant characteristics (students being from the same campus as the institution, there were many similarities), the results should be considered in context and not generalized. Future studies can be carried out to correct these limitations, such as the extension to other institutions, a more significant number of participants, and heterogeneous teams. Further studies should also analyze the possible effects of the participants' performance over the years.

Our studies provide a starting point and important insights regarding the use and development of skills during a short-term PBL event.

## CONFLICT OF INTEREST

The authors declared no conflict of interest.

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# Story Telling Problem Based Learning (ST-PBL): A Program for Rural Elderly with Chronic Diseases

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**Purpose:** To measure changes in health knowledge, health attitudes, and health promotion behaviors of the elderly in rural communities after using the Story Telling Problem Based Learning program facilitated by students in a nursing course.
**Methods:** A quasi-experimental study using a non-equivalent control group: 72 students sampled from the nursing discipline were divided into experimental (n=36) and control groups (n=36). The ST-PBL program was provided to the older rural people in the experimental group for six weeks.
**Results:** Data were analyzed using the SPSS/WIN 21.0. After the application of the ST-PBL program, the participants in the experimental group showed a significant increase in health knowledge and health promotion behavior.
**Conclusion:** The participants in the experimental group demonstrated positive changes in health knowledge, health attitudes, and health promotion behaviours. The use of an approach such as the ST-PBL program can promote uptake of self-care behaviors within the elderly with chronic diseases living in rural areas.

**Keywords:** Problem-Based Learning; Preventive health attitudes; Health promotion knowledge and behavior

Original Article

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## INTRODUCTION

In 2020, older people in Korea accounted for 16.4% of the total population, and now the country is considered an aging society. The elderly population living in rural areas accounts for 16% to 22% of the total resident population, and rural areas often have the status of a super-aging society (Statistics Office, 2020).

As the elderly population grows, it faces several problems. The biggest problem is that most older individuals have chronic diseases. In 2017, the proportion of older people with three or more chronic diseases increased by 20.3% from 51% in 2008, which means that the age of longevity with prevalence of disease is approaching (Statistics Office, 2018). Therefore, appropriate preventive care is as important as treating disease of the elderly in contemporary communities (Yoon, 2017). Problems that arise from chronic diseases in the elderly include physical problems such as discomfort, pain, and dysfunction. In addition, various problems, particularly psychological problems (loss of self-esteem, depression, and stress) and economic difficulties, such as social isolation and weakening of social support, have appeared (Choi, 2012). Therefore, it is necessary to support chronically ill elderly patients in an integrated manner because they must deal with not only physical and emotional problems, but also focus on the issues around social sup-

port difficulties. However, until now, the development of a program which not only follows the PBL philosophy but also actively integrates all aspects of the management of chronic diseases in the elderly had not been created.

The first problem with the management of chronically ill elderly living in rural areas is that systems for patients to actively participate in their treatment have not been not well established. For example, in terms of chronic diseases, the rate of completion of hypertension management education in rural areas was 11.1%, which is below the national figure of 19.4%. In addition, the rate of completion of diabetes management education is 26.5% nationwide, but 16.3% in rural areas, and while there is 16.5% of arthritis management completion rates nationwide, it is significantly lower in rural areas at 3.6% (Korean Center for Disease Control, 2019). The second problem is that the practice rate of daily life health management is low. To minimize the impact of chronic disease, preventive strategies in addition to self-care in daily life are important. When necessary, acute care treatment is available, however the systematized self-care strategies are important and should be continued to the patient's ability. Essential elements for health such as rates of smoking cessation, alcohol consumption, and physical activity, are lower in rural compared to other regions. Smoking in rural areas was 21.8% but 20.1% nationwide; the drinking rate was 60.7%, and 57.3% nationwide, and the rural walking practice rate was 29.6%, lower than the nationwide rate of 39.5% (Korean Center for Disease Control, 2019). One of the goals to be achieved in the National Health Promotion Comprehensive Plan is to bridge the gap between regions and offer population health support nationwide which is adapted to each of the differing needs of the lifestyles in the urban and rural regions.

Park et al (2018) argued that a nursing approach is needed to solve the problems that are present to reduce the health gap between regions. By identifying the reasons for the attrition in programs addressing daily life health practices with respect to chronic diseases occurring in rural communities, the project team suggested approaches to improve chronic disease management that were outside of the usual educational approach and material and then to verify the effectiveness of a program consistent with PBL methodology; more person-centered, involving collaboration between educational providers and the older people using their real-life problems as stimulus for learning about preventive healthcare strategies.

According to the National Assessment of Literacy Survey in the United States, only 3% of the elderly population had adequate health literacy (Speros, 2011). In Korea, approximately 42.8% of older people with a disability, understand and use health information (Lee & Kang, 2008), and the level of literacy on elderly health is relatively low (Park & June, 2011). Therefore, to provide health information for rural seniors, there is an urgent need to develop suitable education programs. However, publicly available information on the use of healthcare is often difficult to understand: It is written in a complex manner making it difficult for the elderly creating barriers to use of self-care strategies to address problems (Lee & Park, 2010). Without considering the appropriate educational approach for the elderly, educational materials are generally considered ineffective (Lee, 2018).

The storytelling learning method is a suitable pedagogical method for the elderly because they experience memory loss due to aging or difficulty in physical functioning and in accepting and using new things in life (Gee, 2013). Storytelling or "the act of telling a story" (Ahn, et al, 2013) can be used as a critical alternative to the traditional learning methods in various subjects and contemporary education programs (Eagon, 2005). Storytelling is a motivational approach that captures the desire for memorable moments in learning, helps the learners with recall of stories, and has a great educational effect on replay (Lee, 2008). Vivian (2009) explained that intentional storytelling works because it brings fact-based information along with emotion-based human interest, and that these emotions play an important role in our ability to understand new thoughts. Using storytelling, simple stories provide stimuli for learning and this helps in the process of finding various problems in the story and the storyteller finding answers themselves. In this way customized educational programs tailored to the elderly can be offered. In addition, through this approach, storytelling about a health-related problem based on a classic story that many elderly people have encountered. It is an educational approach that accurately reflects the characteristics of the elderly who are planning to proceed to finding answers that meet their own needs. Following the development of a ST-PBL program to improve the health promotion ability of the elderly with chronic diseases living in rural areas, the authors were keen to examine the nature and extent of the older persons':

1) Health knowledge about their own needs
2) Attitudes to addressing health problems
3) Health promotion behavior that was new to them.

## METHODS

### Conceptual framework

The conceptual framework of this study was used in previous research by Wan et al. (2016). The framework consisted of the knowledge, attitude, practice-performance model (knowledge, attitude, practice-outcome model, KAP-O model) (Figure 1).

**Program setting and participants**

Chronic disease refers to health breakdown where physiological function gradually declines and degenerates and causes disorders that increase demand for services characterized by rehabilitation therapies and continuous supervision, observation for the emergence of health deterioration, and nursing intervention (Shin et al, 2019).

In this study, only hypertension, diabetes, and hyperlipidemia were included in our use of the Korean National Health and Nutrition Examination Survey (KNHANES). The subjects were elderly people aged 65 and over, who lived in rural areas where their diagnosis of chronic diseases had taken place more than 1 year previously.

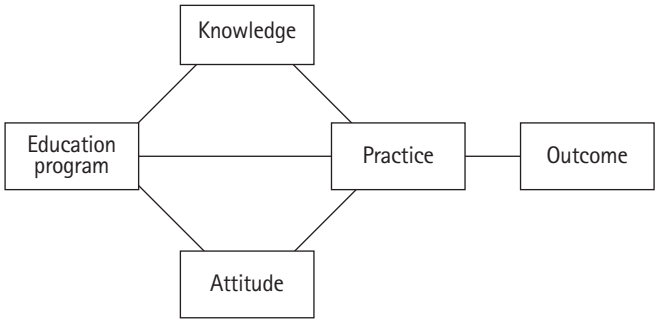


**Figure 1.** Conceptual framework.

**Program composition and progress conceptual framework**

To develop the educational program of this study, the intervention mapping protocol (IMP) method by Bartholomew et al. (2016) was applied as shown in Figure 2.

*Step 1: Needs assessment*

Specification of the health-related problems and who needs to change as the focus for the project. Confirmation of the issues and needs assessment took place through a literature review, questionnaire survey, and interviews. The literature review provided evidence of educational levels of education as one reason for difficulty in managing chronic diseases among older people living in rural communities. Feedback from interviews and surveys with elderly residents in the community, supported the need for education but

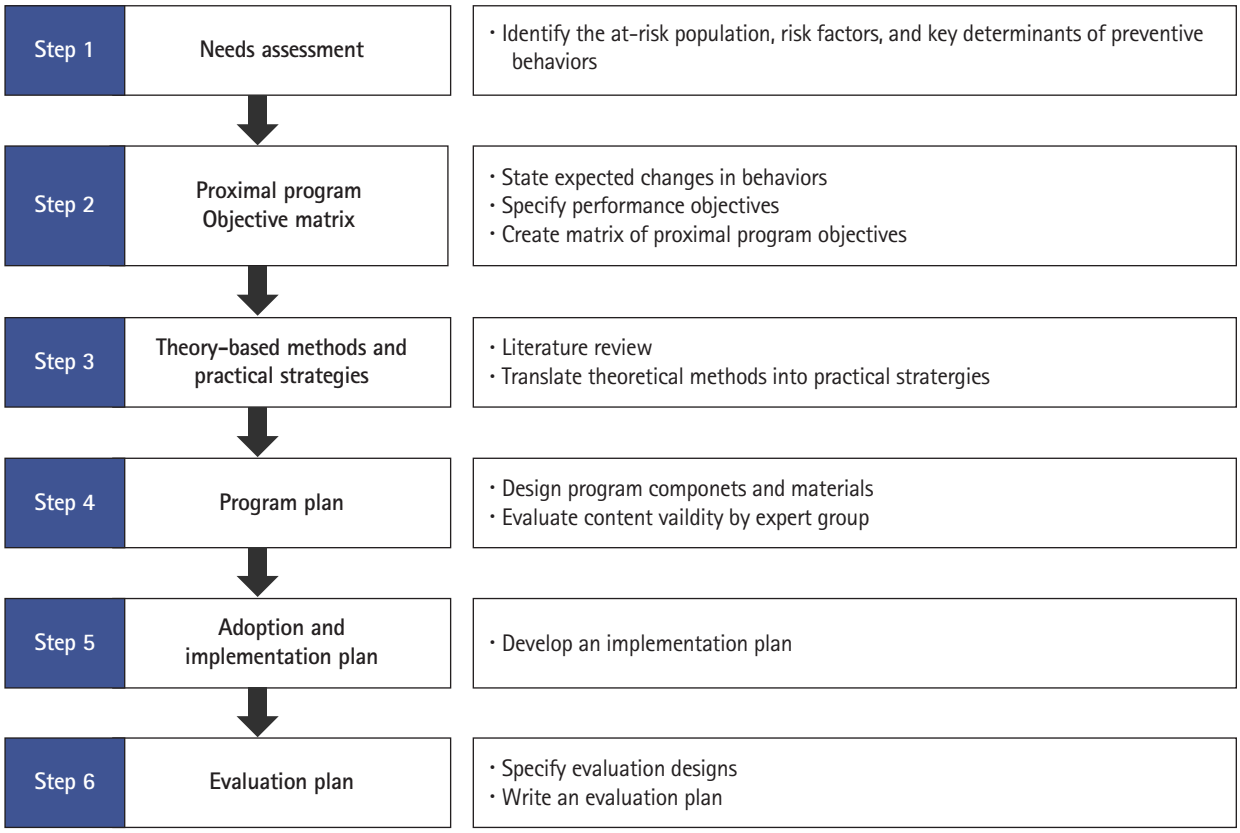


**Figure 2.** Program composition and progress.

also found that the content of existing educational offerings was difficult and boring.

*Step 2: Proximal program objective matrix*

Goal setting is the process of subdividing performance goals by describing the outcomes expected to be achieved through mediation. The most important issue identified was to induce changes in behavior by changing attitudes informed by knowledge. To induce behavioral change, a program was constructed to develop a positive attitude by providing basic knowledge about chronic disease and ways to manage symptoms. The degree of achievement of the goal was measured the end of the program.

*Step 3: Theory-based methods and practical strategies*

In this step, the process of selecting theories was applied to achieve behavioral change, by turning theoretical concepts into actionable activities. It was constructed based on the KAP-O model to change the health promotion behavior of the elderly living in the community. In the KAP-O model, the ST-PBL program needs to provide the necessary information and motivation for changes in behavioral skills. Unlike existing educational programs, this ST-PBL program has a strategy that can be easily accessed by storytelling, through the classic Korean novels (Heungbu & Nolbu and Kongjwi Patjwi, Simcheongjeon). It is a novel that is easy for the elderly to understand, and through its use, the elderly can learn about health-related knowledge and use it to develop a positive attitude to preventive health behaviors.

*Step 4: Program plan*

In the program content development stage, an appropriate program is developed through the process of the previous three stages, and the mediation protocol or data are described. Each participant was asked to read the three classic novels, the story of Nolbu, who overeats in Heungbu and Nolbu; the story of Patji, who does not exercise in Kongji and Patji; and the story of his father, who does not take medicine properly in Shimcheongjeon, and were asked to present their thoughts on each story. In addition, the participants talked about solving problems as if they were the main characters. Finally, a game format was arranged in accordance with the traditional Korean game Yutnori for each story. The rule of Yutnori is to first throw the yut and move it by the number that came out. In the experimental group, people had to solve the quiz. If the experimental group participants get the quiz right, they can stay where they are, and if they get it wrong, they go back one step. The program content was verified by four expert nurses, two specialized in care of older people.

*Step 5: Adoption and implementation plan*

In practice, this is the stage of planning the application timing and execution method. This program was conducted for the elderly using the Gwangyang Health Clinic. When trying to change the subject's knowledge and attitude, it is difficult to obtain effective results through a short-term educational program (Im & Yun, 2020). Most of the studies conducted on older adults showed behavioral changes over 4 weeks, so the program was designed for a 6-week period. In addition, the small group composition, which is one of aspects of the training program, is an effective way to induce behavior change through the process of providing information for problem solving, presentation, and discussion while conducting PBL processes. A small group size of 6–8 people is most suitable (Yalom, 1985), so this program used 6–8 people. In addition, at the time of this program, group training was prohibited to prevent the spread of COVID-19 in the region, so it was conducted in small groups. The program was conducted using one novel for two weeks. The first week used a method of finding and solving problems within the story and the second week proceeded with a quiz related to this, but as a game through Yutnori.

*Step 6: Evaluation plan*

This is a step toward evaluating the effectiveness of the final program. This involved assessment of the value of program design and application, and any changes made after program application involving six senior citizens and their understanding of the content and difficulties related to the quiz.

## Methodology

A quasi-experimental design involving a non-equivalent control group was used to verify the effect on health knowledge, health attitude, and health promotion behavior in the group to which the ST-PBL model was applied for 6 weeks. The data were analyzed using the SPSS/WIN 21.0. The general characteristics of the study subjects were averaged and converted to percentages, and the reliability of the measurement instrument was calculated using Cronbach's alpha. The Kolmogorov-Smirnov test was carried out to check whether the collected data were normally distributed, and the chi-square test and t-test were inherently homogeneous.

## Instruments

1) Health knowledge: This was measured using the Aged People Health Knowledge Measurement tool developed by Ha (2004). The tool involved 10 questions, using "yes" and 1 point for correct responses; "no" for incorrect and "don't know" for unsure, both 0 points. The highest possible score was 10 points, the

lowest 0.

2) Health attitudes: To measure the health attitudes of the elderly, the tool developed by Torabi et al. (2004) was modified and supplemented by the work of Yoon (2017). This tool is composed of three categories with 10 questions: health emotions (n = 3), disease prevention and health lifestyle beliefs (n = 3), and action intention to be healthy (n = 4). A five-point Likert scale was used where "Very rarely" (1) and "Most frequently" (5). The higher the score, the more positive the health attitude.
3) Health promotion behavior: The Health Promotion Lifestyle Profile (HPLP) modified by Hong (2003) to suit the elderly was used. The HPLP tool was created by Walker, Sechrist, and Pender (1987). This tool is composed of six categories with 35 questions: nutrition (6), stress management (5), interpersonal support (6), exercise (2), health responsibility (11), and self-actualization (5). The four-point Likert scale ranged from "Very rarely" - 1 point to "Most frequently" - 4 points. The scores possible were a minimum 35 and maximum 140 points: the higher the score, the better the health promotion behavior.

**Ethical considerations**

This study was approved by the Cheongam University Bioethics Review Committee, Korea (No. 20-HR-013-01/CA17-190326-005-02). Survey materials with written consent forms and analysis of the data were stored in a locked file cabinet located in the principal investigator's office. Participants were informed that they could drop out at any time, without any consequences. After the end of the study, the same program was provided to the control group in consideration of an ethical response to their shared needs.

## RESULTS

Verification of the Homogeneity of General Characteristics of the Subjects: As a result of testing the general characteristics of the subjects and their homogeneity, there was no statistically significant difference in the general characteristics of the subjects such as age, religion, marital status, domestic family, educational attainment, drug use, and subjective health status. It was found to be homogeneous (Table 1).

Verification of Homogeneity in physiological indicators: The subjects' blood pressure (systolic and diastolic), diabetes (blood

**Table 1.** General characteristics and homogeneity test (N=68)

| Variables | Categories | n(%) | | $\chi^2$ or t | *p* |
|---|---|---|---|---|---|
| | | Exp. (n = 34) | Cont. (n = 34) | | |
| Ages | Under 75 | 47 (69.1%) | 21 (61.8%) | -0.761 | 0.449 |
| | Over 75 | 21 (30.9%) | 13 (38.2%) | | |
| Religion | Yes | 18 (52.9%) | 23 (67.6%) | 1.235 | 0.221 |
| | No | 16 (47.1%) | 11 (32.4%) | | |
| Living with | Yes | 16 (47.1%) | 16 (47.1%) | 0.479 | 0.634 |
| | No | 18 (52.9%) | 18 (52.9%) | | |
| Education | < Elementary | 12 (35.3%) | 12 (35.3%) | 0.371 | 0.712 |
| | Middle | 17 (50.0%) | 19 (55.9%) | | |
| | > High school | 5 (14.7%) | 3 (8.8%) | | |
| Drug | Yes | 28 (82.4%) | 23 (67.6%) | -1.400 | 0.166 |
| | No | 6 (17.6%) | 11 (32.4%) | | |
| Subjective health status | Good | 3 (8.8%) | 3 (8.8%) | 0.376 | 0.708 |
| | Not bad | 15 (44.1%) | 17 (50.0%) | | |
| | Bad | 16 (47.1%) | 14 (41.2%) | | |
| Blood pressure | Systolic | 126.7 ± 9.87 | 127.2 ± 9.25 | -0.20 | 0.840 |
| | Diastolic | 75.0 ± 8.99 | 74.8 ± 10.74 | 0.09 | -0.922 |
| Diabetes mellitus | Blood sugar | 117.5 ± 26.26 | 121.5 ± 22.9 | -0.67 | 0.503 |
| | HbA1c | 5.5 ± 0.61 | 5.5 ± 0.63 | -0.17 | 0.861 |
| Lipid | TC | 161.4 ± 35.41 | 152.36 ± 0.35 | 0.98 | 0.329 |
| | TG | 113.8 ± 18.49 | 114.4 ± 49.9 | -0.04 | 0.966 |
| | HDL | 56.8 ± 18.4 | 49.00 ± 18.31 | 1.76 | 0.082 |
| | LDL | 81.8 ± 27.8 | 77.67 ± 0.31 | 0.57 | 0.567 |

sugar, HbA1C), and cholesterol (TC, TG, HDL, and LDL) in the experimental and control groups did not show statistically significant differences (Table 2).

Verification of Homogeneity in Dependent Variables: The subjects' health knowledge, health attitude, and health promotion behavior in the experimental and control groups did not show statistically significant differences (Table 2).

**Verification of Hypotheses:**

1) Hypothesis 1- The experimental group that participated in the ST-PBL program would have higher health knowledge scores compared to the control group that did not: Findings showed that the health knowledge score of the test group was

5.29 out of 10 before education and increased to 5.94 thereafter, after which there was a statistically significant increase (t = -3.73, $p$ = .001). The health knowledge in the control group was 5.24 before education and 5.24 thereafter, not a significant difference (t = -1.22, $p$ = .066). Therefore, this hypothesis is supported (Table 3).

2) Hypothesis 2- The experimental group that participated in the ST-PBL program would have higher health attitude scores compared to the control group that did not. The findings showed that the health attitude score of the test group before training was 3.51 out of 5 and increased to 3.55, after training (t = -0.52, $p$ = .605). The health attitude score of the control group was 3.47 before training and 3.23 thereafter, not statistically significant differences (t = -1.01, $p$ = .319). This hypothesis is not supported (Table 3).

**Table 2.** Homogeneity Test for Demographic Characteristics and Dependent Variables (N=68)

| Variables | M ± SD | | t | $p$ |
|---|---|---|---|---|
| | Exp. (n = 34) | Cont. (n = 34) | | |
| Health knowledge | 5.29 ± 1.03 | 5.24 ± 1.13 | 0.560 | 0.577 |
| Health attitude | 3.51 ± 0.48 | 3.47 ± 0.48 | 0.365 | 0.716 |
| Health promotion behavior | 3.06 ± 0.37 | 3.05 ± 0.37 | 0.138 | 0.891 |

**Table 3.** Comparison of Dependent Variables between Two Groups after Treatment

| Variables | Groups | M ± SD | | t ($p$) |
|---|---|---|---|---|
| | | Pretest | Posttest | |
| Health knowledge | Exp. | 5.29 ± 1.03 | 5.94 ± 0.34 | -3.73 (.001) |
| | Cont. | 5.24 ± 1.13 | 5.24 ± 1.34 | -1.22 (.066) |
| Health attitude | Exp. | 3.51 ± 0.48 | 3.55 ± 0.33 | -0.523 (.605) |
| | Cont. | 3.47 ± 0.48 | 3.54 ± 0.31 | -1.012 (.319) |
| Health promotion behavior | Exp. | 3.06 ± 0.37 | 3.55 ± 0.31 | -2.04 (.022) |
| | Cont. | 3.05 ± 0.37 | 3.06 ± 0.32 | -2.75 (.510) |
| Systolic blood pressure | Exp. | 126.7 ± 9.87 | 119.52 ± 11.62 | 5.289 (.000) |
| | Cont. | 127.2 ± 9.25 | 130.3 ± 10.22 | -1.102 (.278) |
| Diastolic blood pressure | Exp. | 75.0 ± 8.99 | 72.73 ± 8.05 | 2.031 (.050) |
| | Cont. | 74.8 ± 10.74 | 73.6 ± 10.49 | 1.953 (.059) |
| Blood sugar | Exp. | 117.5 ± 26.26 | 118.73 ± 25.61 | -1.488 (.146) |
| | Cont. | 121.5 ± 22.9 | 118.0 ± 29.37 | 0.586 (.562) |
| HbA1c | Exp. | 5.5 ± 0.61 | 5.52 ± 0.40 | -0.154 (.879) |
| | Cont. | 5.5 ± 0.63 | 5.57 ± 0.36 | -0.370 (.714) |
| TC | Exp. | 161.4 ± 35.41 | 137.11 ± 32.44 | 4.056 (.000) |
| | Cont. | 152.36 ± 0.35 | 143.9 ± 38.87 | 1.687 (.101) |
| TG | Exp. | 113.8 ± 18.49 | 106.64 ± 53.46 | 2.417 (.021) |
| | Cont. | 114.4 ± 49.9 | 113.6 ± 48.95 | 1.919(.064) |
| HDL | Exp. | 56.8 ± 18.4 | 59.44 ± 19.03 | -3.100 (.004) |
| | Cont. | 49.00 ± 18.31 | 46.97 ± 19.43 | 1.563 (.128) |
| LDL | Exp. | 81.8 ± 27.8 | 76.64 ± 25.26 | 3.22 (.002) |
| | Cont. | 77.67 ± 0.31 | 91.91 ± 33.37 | -1.625 (.114) |

3) Hypothesis 3- The experimental group that participated in the ST-PBL program would have a higher health promotion behavior score compared to the control group that did not. The findings showed that the health promotion behavior of the test group was 3.06 out of 4 before the training and 3.55 after the training, a statistically significant increase (t = -2.04, $p$ = . 022). The health promotion behavior of the control group was 3.05 before the training and 3.06 after the training, not a statistically significant difference (t = -2.75, $p$ = .510). This hypothesis is supported (Table 3).

Positive changes in physiological indicators: In the experimental group participating in the ST-PBL program, systolic blood pressure (t = 5.289, $p$ < .001), TC (t = 4.05, $p$ < .001), TG (t = 2.417, $p$ = .021), HDL (t = -3.10, $p$ = .004), and LDD (t = 3.22, $p$ = .002) positively changed.

## DISCUSSION

The purpose of this study was to verify the effects on health knowledge, attitudes, and health promotion behaviors by applying programs provided to the elderly with chronic diseases in rural areas, and to discuss the results.

The health knowledge score of the elderly living in rural areas improved to 5.94 out of 10 points after the program was applied, proving the effectiveness of this program. In previous studies, the health knowledge score of the elderly who lives in city was 7.51 points, and in a study by Park & June (2011) and Kim et al (2008), their score was 7.10 points, which was higher than the results from this study. Hwang (2016) study of older people in rural areas have low understanding of health-related knowledge, confirming a need for change. Existing lecture-style educational methods that simply deliver information are not suitable for older people in rural areas with relatively low understanding of health issues. Use of the classic novels facilitated exploration of health-related problems like their own, ways to solve the problems on their own, and apply new knowledge through participation in games at the end of the program. This new educational method for the rural elderly was engaging, learner centered and promoted ongoing learning through behavior change.

The results of this study showed that the health attitude scores of the experimental group did not increase significantly. As there are no previous experimental studies to improve the health attitudes of the elderly, comparisons are limited. According to Yoon (2017), the more positive the health attitude, the higher the health promotion behavior. Attitudes toward health are composed of positive emotions related to health, attitudes toward disease prevention and lifestyle, and intentions for health behavior. If they show a very high causal relationship with health promotion behaviors, a change in positive health attitudes is important. Changes in health attitudes are important because health behaviors, such as the management of hygiene related diseases, are added. First, the correct attitude change requires new knowledge (Kim & Yoon, 2012). However, positive attitude changes that can induce behavioral changes are not formed in a short period of time (Im & Yun, 2020). Since this program was applied for a short period of 6 weeks, there was a limit to our ability to confirm changes in the attitudes of the older people. Therefore, educational strategies over a longer timeframe are recommended for future education programs.

The health promotion behavior scores of the experimental group participating in this study increased significantly after the program. Previous studies have indicated that there is a correlation between health knowledge and health-promoting behavior (Kim et al, 2008, Park et al., 2018, Hwang, 2016). To maintain and improve the health of older people, it is necessary to provide continuous meaningful and relevant health management tools so that self-care can be performed. In other words, it is necessary to provide up-to-date health showcase preventive health behaviors and information about how best to live a healthy retirement. Improvements in lifestyle habits for chronic disease management are not made within a short period of time, but it is important for older people in collaboration with health professionals to make continuous efforts with patience and persistence; this will ultimately lead to behavioral change through education and counseling (Son & Song, 2007).

It is difficult for the elderly to change their behavior for self-care because of the lifelong habits, beliefs, and attitudes that have remained fixed over the years. However, most of the previous studies in Korea have applied an educational program with one topic such as nutrition, exercise, and maintenance to manage chronic diseases in the elderly. In contrast, many studies abroad have focused on lifestyle changes (Burke et al., 2005;Drevenhorn et al., 2007;Miura et al., 2004), rather than single interventions such as exercise and nutrition. To overcome the limitations of domestic research, a change in health must be brought about so that an educational program with integrated management strategies can be applied.

Results were collected on the last day of the six-week study by the lead researcher via participant surveys, BP and blood tests (table 1). The results of this study showed that in the experimental group participating in the ST-PBL educational program, systolic blood pressure, TC, and TG decreased, and HDL significantly increased compared to the control group. These results are difficult to directly compare because there are few previous studies that have applied education programs for chronically ill patients living

in rural areas. The study results of Sung et al (2018) decreased in TC and TG. Also, the results of the study by Sung & Lee (2010) are like those in which TC decreased. These are the same as the result of a study in which the blood pressure of participants was reduced within a project relying on small group discussions (Zhang & Kim, 2016). Although the content of this program is different, it is true that when an appropriate educational program is provided for the elderly, a positive effect appears on physiological indicators. Therefore, it is necessary to develop and apply educational programs suitable for the elderly to bring about positive effects.

## CONCLUSION

In this experimental study, the ST-PBL program was developed and applied to the elderly with chronic diseases living in rural areas. The influence of the program was evaluated in terms of health knowledge, health attitudes, and health promotion behaviors. It was demonstrated that the health knowledge and health promotion behaviors of the experimental group who participated in the ST-PBL program were enhanced. The use of elements of PBL within the educational program (use of small groups, relevant stimulus material focused on the learners' real needs, seeking new knowledge for application to daily practice), can improve appreciation of the value of self-care skills in managing symptoms of chronic diseases.

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## CONFLICT OF INTEREST

The authors declared no conflict of interest.

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# Development of A Design Thinking-Based Korean Language Curriculum Literacy Program for Preliminary Korean Language Teachers

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**Purpose:** To demonstrate that curriculum expertise required of prospective Korean teachers based on design thinking is needed for both the development and implementation of programs relevant to student needs.
**Methods:** The concepts and characteristics of design thinking, followed by its relevance to teacher education were explored. Then concepts and elements within the theory informing curriculum literacy were reviewed before articulating its value in professional development of Korean language teachers' curriculum literacy.
**Results:** Based on theoretical considerations, a program that can enhance Korean language curriculum literacy according to the stages of design thinking was developed.
**Conclusion:** The results of this study suggest that preliminary Korean language teachers will be able to systematically develop the curriculum expertise required of teachers by participating in the Korean language curriculum literacy program of teacher training institutes.

**Keywords:** Design Thinking; Korean Language Curriculum Literacy; Preliminary Korean Language Teachers

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## INTRODUCTION

Contemporary educational methodologies and philosophies like Problem-based Learning (PBL) that aim for more student-centred processes for learning, require teachers to assist learners to come to meaningful learning through a thorough examination of the processes used to arrive at their understandings. In this paper, the professional practice examined is that of teacher education, specifically focussing on the concept of curriculum literacy. i.e., the ability to develop, implement and evaluate curricula. The specific real-world context of the person responsible for this professional development is developing curriculum literacy in Korean language teachers.

Although national-level curricula present educational goals, content, and methods and the direction of evaluation, there are clear differences from the classroom-level implementation where various and complex elements dynamic classroom instructions are intertwined. Therefore, no matter how well national-level curricula outline the changes of the times and society, the success or failure of education is determined by how the curricula are implemented in practical situations at the school or classroom level.

The 2015 revised curriculum recently announced by the Ministry of Education aims to cultivate talented individuals equipped with creative convergent thinking and problem-solving capabilities. Therefore, teachers must have the professional competence to actively develop, practice, and evaluate curricula in the practical educative situations, rather than passively imple-

menting the national-level curriculum.

As autonomous operators of the curricula, teachers are required to have the ability to interpret and autonomously come to an understanding of national curricula, develop them into appropriate classroom-level programs considering context variables (students, classrooms, schools, local communities, educational policies, etc.) and implement the resultant curriculum as learning events. This ability is referred to as curriculum literacy.

Although curriculum literacy is a very important professional and core competency required of teachers, there are few high-quality studies on developing curriculum literacy and discussions on the development of professional attributes within teacher education programs. Given the reality that teachers who teach subjects in secondary schools often take a one-time training course to develop curriculum literacy for reasons of entrance exam guidance and workload, it is believed that systematic education for the development of preliminary teachers' educational curriculum literacy is necessary at colleges of education that cultivate secondary school teachers. Therefore, based on the definition of curriculum literacy required of teachers, the present study proposes an educational program that can contribute to the development of the Korean language curriculum literacy of preliminary Korean language teachers who are preparing to become secondary school Korean language teachers.

Korean language curriculum literacy points towards the curriculum expertise required of Korean language teachers and is limited to the subject of Korean language from the concept of curriculum literacy. In particular, the present study tried to develop a design thinking-based education program to successfully support curriculum literacy development education for preliminary Korean language teachers. Design thinking is also an educational methodology developed by IDEO and Stanford University based on the thinking style of designers who innovate and create objects. Design thinking is regarded as a creative problem-solving strategy necessary for solving real-world problems and is widely used in fields such as design, management, society, and education.

There is little interest in design thinking in teacher education, and it has hardly been discussed in relation to the Korean language subject. Studies related to curriculum expertise include Park (2019), but these are not empirical studies on design thinking education.

In classrooms, teachers undertake tasks to creatively solve classroom management problems in which complex elements such as the level and demands of students, textbooks, media, and classroom space as well as addressing specific elements of national-level curricula are entangled. Therefore, teachers are curriculum designers who must also develop and implement classroom-level curricula.

It is important to acknowledge that the content of Korean language education includes the knowledge, skills, and attitudes necessary for actual human linguistic practice, and a characteristic of Korean language education is dealing with language phenomena, which are problems that are diversified and complex, and cannot be solved entirely. In addition, the essence of language includes communication, cognitive, and problem-solving processes. Design thinking also includes a process of cooperatively solving problems through communication and cognitive processes.

Considering the various aspects outlined above, design thinking has the potential to be applied to Korean language development and curriculum literacy for teacher education. Therefore, the present study aims to develop a design thinking-based educational program that focuses on improving the curriculum literacy of preliminary Korean language teachers. This program can be used by colleges of education that train secondary school Korean language teachers.

## METHODS

### Concept and characteristics of design thinking

Design thinking discourse around the way designers engage in processes of work performance began in the 1960s; discussion about this approach continued until the 1990s. The term was first used by cognitive psychologist Herbert Simon in "The Sciences of the Artificial" (1969). He defined design thinking as "a process to solve all problems in human life, such as society, culture, economy, politics, and environments through interdisciplinary cooperation in mesh with the integrative and comprehensive problem-solving ability of design" (Kim 2015). Since the 2000s, discussion has turned to the concept as an innovation strategy in the management discourse of companies or organizations. Tim Brown of IDEO, a design consulting firm, said in the feature article "IDEO Design Thinking" in the Harvard Business Review in 2008, that design thinking is necessary to solve complex problems.

The momentum for design thinking to appear in educational discourse was the establishment of Stanford University's d.school. This school established a series of thinking processes that went beyond the conceptual level and implemented 'design thinking education'. This has resulted in a new educational methodology that can foster creative problem-solving ability. D-School's design thinking process consists of five stages.

Empathize, the first stage, is where one observes people facing a problem and forms a consensus with them. To that end, one uses methods such as field surveys, follow-up observations, interviews, and questionnaire surveys. In the second stage, Define, the prob-

lem that must be solved is identified based on the results obtained in the Empathize stage. In the third stage, Ideate, one collects various ideas to solve the defined problem. Examination of the problem from various angles occurs, using methods such as brainstorming, and brainwriting based on intuition, experience, and expression of opinion with an open attitude and permissive atmosphere to welcome any idea. In the fourth stage, Prototype, these are quickly developed based on the derived ideas with cheap materials, checking the feasibility of the ideas through immediate feedback. In the final fifth stage, Test, the prototypes are applied to actual situations to evaluate whether the ideas are suitable for solving the problem.

The characteristics of design thinking that progresses in five stages can be summarized as follows. First, design thinking is an innovative thinking methodology that provides human-centered solutions to problems. Design thinking regards activities such as observing, emphasizing with, and analyzing human problem situations as important to solve problems. Second, design thinking acknowledges collective intelligence and cooperative problem-solving processes as important. To solve problems in which complex elements are intertwined, people with various ideas, experiences, and abilities gather and enjoy the process of finding solutions through various experiments. Third, design thinking seeks a balance between convergent and divergent thinking. The five-step thinking process involves repetition of the processes of divergence and convergence.

**Design thinking and teacher education**

Recently, design thinking has been seen as a key to solving the problems of future-oriented education. Accordingly, interest is growing in the concept as a core element for quality teacher professionalism. However, discussion on design thinking in teacher education seems limited; discussion can be divided into conceptualization of design thinking, its educational effects, and teachers' perceptions of it.

First, studies that conceptualized design thinking in terms of teacher education are examined. Kim et al. (2014) cited the fact that as a future educational paradigm, design thinking in the field of pedagogy aims to make learners constructively create new values and knowledge and aim for desirable changes in the learning group. They suggest that it is focused on solving difficult problems in education and that it promotes collaboration and participation. It is also suggested that it pursues visualization, and that it is focused on problem solving and processes as conceptual characteristics.

Kim et al. (2018) make the point that educational design is accepted as a universal learning approach involving classroom lectures and curriculum frameworks. Educational activities combine design thinking, school space design, and universal design. Design is used as a strategic method to overcome the problems of education and promote changes in education in the future. The above two studies highlight the attributes of design and provide a clue about how future approaches to education should respond to the impact of social challenges. Unlike the above studies, Park (2019) said that design thinking makes preliminary teachers form a habit to better understand and solve problems in a manner that designers do. In this way preservice classes enable prospective teachers to become more flexible and adaptive teachers. Park's study (2019) viewed teachers as designers and suggested that design thinking is necessary to foster the professionalism of teachers.

Second, there are studies that applied design thinking to teacher education and verified the educational effectiveness using quantitative research methods. Nam et al. (2019) indicated that there were significant differences in learners' group cohesiveness (group task-related integration) and cooperative learning attitudes (reward interdependence). Park (2017) developed a design thinking-based class design model, and in a follow-up study, Park (2019) reported that the educational effects were verified and helped preliminary secondary teachers in their class design ability.

Third, there are qualitative studies on teachers' perceptions of design thinking. Lee & Ahn, (2020) reported that classes using a design thinking model were conducted for young children, and according to the results, the classes had significant effects in terms of creativity, empathy ability, flexible thinking, considerate thinking, and enjoyment of collaboration. Lee & Kim, (2020) analyzed design thinking-based educational practice activities and found that active participation increased over time, and participants emphasized the necessity of design thinking.

To judge from the study results above, design thinking is an educational methodology that can contribute to solving complex problems inherent in educational phenomena and is an educational device that is expected to have positive educational effects.

A useful example of the interrogation of the thinking processes in a professional practice is that presented by Razzouk & Shute, (2012) in relation to the professional practice of Design. They present a set of dimensions, which they argue describes the differences among disciplines/professional practice and their ways of thinking and proposes a process of thinking that describes and informs the professional practice of design. At the same time, they argue that other professions would use different processes based on the placings along each of the four dimensions and that the position of the discipline/profession may vary in different circumstances and therefore apply multiple ways of thinking in any given situation. The dimensions are on 2 axes: the horizontal describes the processes - finders or discoverers (analytical) and the makers

(synthesisers): the vertical axis describes the content, being symbolic (representation) and real (real world). The two axes result in 4 quadrants: Analytical Symbolic. Synthetic Symbolic; Analytic Real; Synthetic Real. The authors argue that Designers are mostly Synthetic Real.

In this paper, the professional practice examined is that of education, specifically, curriculum literacy. i.e., the ability to develop, implement and evaluate curricula. The specific real-world context is developing curriculum literacy in Korean language teachers. It can be argued that Teacher Educators are in the Synthetic Real quadrant, i.e they are making new meaning for the learner, new ways of thinking about the real world of teaching/and learning and developing creative solutions to classroom teaching such as PBL itself.

**Concept and elements of Korean language curriculum literacy**

Literacy refers to "the ability to read and write" and has recently been extended to the ability to interpret, understand, and think critically about something. Earlier the concept of curriculum literacy was defined as the ability of teachers to use, improve, and develop an externally developed curriculum based on their knowledge of the curriculum (Rudduck 1987; Ariav 1988; Ben-Peretz 1990).

Jeong (2002), who first discussed Korean language curriculum literacy, introduced the concept in a study that analyzed the implementation factors and aspects of the Korean language curriculum, and defined it as the ability to read and understand the curriculum and implement it. Studies on the concept are as follows.

Jeong (2012) saw curriculum literacy as necessary for teachers to use national-level curriculum documents and implement them in classes. A study by Paik (2013), which discussed curriculum literacy from a more expanded perspective, regarded it as teachers' ability to comprehensively integrate the background of the curriculum, the basic direction presented, and the content of the subject in their expertise through the learning process to read, interpret, and understand the curriculum and continuously use the outcome in classes. Park et al. (2017) defined curriculum literacy as teachers' ability to go beyond understanding the intention of external developers through the interpretation of the curriculum to the stage where they can rewrite the curriculum, if necessary. Seong (2019) defined curriculum literacy as teachers' ability to interpret various things related to education, develop curricula to fit the field, and implement the curricula.

A study by Song (2020) is a recent noteworthy discussion on teachers' curriculum literacy. This study defined curriculum literacy as the ability of teachers to comprehensively form their knowledge of curricula such as the background and basic direction and the content of the subject/s; they could cast their discerning eye for the curricula through a process of reading, interpreting, and understanding curriculum documents and continuously using the knowledge for the development of classroom curricula.

Jeong (2012) and Paik (2013) viewed curriculum literacy from the viewpoint of teachers' "interpretation" or "utilization" of curricula. While Park et al. (2017) and Seong (2019) included viewpoints on "development" and "implementation," Song (2020) emphasized the need for a critical attitude and continuous utilization.

In this regard, the meaning of curriculum literacy is gradually expanding. Referring to the concepts above, Korean language curriculum literacy conceptualized at the level of a certain "subject" refers to the "ability to read, write, develop and implement the Korean language curriculum". Korean language curriculum literacy is central to the professionalism of teachers who teach Korean language after developing and implementing a classroom-level curriculum based on their interpretation and understanding of the national-level curriculum. The various elements of curriculum literacy that must be developed by teachers are presented by several scholars. Table 1 summarizes previous studies on curriculum elements (Song 2020:36 revision).

In Table 1, curriculum literacy is generally divided into the categories "understanding" and "practice." Curriculum "understanding" is the ability to know and interpret the general theory of curricula, the nature of particulars (subjects), development direction, system, characteristics, goals, contents (achievement standards), teaching and learning methods, evaluation directions, to use curricula. Previous studies included "base, deliberation, analysis, interpretation, reading comprehension" as part of the process of 'understanding'.

Curriculum "practice" involves creating a new curriculum for the purpose of implementing the interpretation of the curriculum in classrooms. To that end, the classroom context, and the curric-

**Table 1.** Elements of curriculum literacy derived from previous studies

| Scholar | Element |
|---|---|
| Rudduck (1987) | Base, deliberation, adjustment, criticism |
| Ariav (1988) | Analysis |
| Ben-Peretz (1990) | Interpretation, development |
| Jeong (2002) | Meaning, composition |
| Jeong (2012) | Reading, mapping, use |
| Paik (2013) | Reading comprehension, interpretation, utilization |
| Seong (2019) | Interpretation, development |
| Song (2020) | Reading comprehension, use |

ulum to be implemented are analyzed, interpreted, and organized; class and evaluation plans are established, teaching materials developed, and the classroom environment is created to apply them to actual classes. Previous studies referred to "adjustment, criticism, analysis, composition, mapping, use, utilization, development" as part of 'practice' processes.

From Table 1, the elements of Korean language curriculum literacy can be divided into "understanding" and "practice," and summarized as shown in Table 2.

The concepts and elements of Korean language curriculum literacy presented above were reflected in the development of the design thinking-based Korean language curriculum literacy education program in this study.

## Design Thinking-based Korean Language Curriculum Literacy

*Key elements of Program for Preliminary Korean Level Studies*

In this study, the direction of development of the design thinking-based Korean language curriculum literacy program was set as follows based on the consideration of previous studies on design thinking-based teacher education, curriculum literacy, Korean language curriculum literacy.

First, the educational goal of this program is to enable preliminary Korean language teachers to cultivate Korean language curriculum literacy using design thinking strategies. The program deals with the knowledge, skills, and attitudes necessary for cultivating Korean language curriculum literacy, focusing on the curriculum expertise that Korean language teachers should have. Keynotes of program composition were derived as shown in Table 3.

Second, in the case of the educational method in this program, the main activity is the thinking process to solve the project topic presented by the researcher. In this program, the preliminary Korean language teachers come together to conduct project activities according to design thinking. The project theme is "Developing a teacher-level Korean language curriculum for Korean language-friendly classrooms and student-customized Korean language classes." In this project, it is assumed that the preliminary Korean language teachers assume the role of "real teachers" and meet a student who is having difficulties in learning the Korean language and develop a customized teacher-level Korean language curriculum together with fellow teachers to explore potential solutions the "student's problem situation."

To that end, the preliminary Korean language teachers must first find the real contributing problematic issues by recruiting, observing, and interviewing students who are experiencing problem situations to carry out the project. Then, the teachers plan an analysis of educational conditions and environments, analysis, results desired from students, curriculum development and operation direction, etc.

Next, the preliminary Korean language teachers analyze the content, system, and achievement standards in the 2015 revised

**Table 3.** Content of Korean language curriculum literacy program education

| Category | Major contents |
|---|---|
| Knowledge | -Curriculum knowledge |
| | -Korean language curriculum knowledge |
| | -Design thinking knowledge |
| | -Korean language curriculum literacy knowledge |
| Skill | -Design thinking method |
| | -Teacher-level curriculum development method |
| Attitude | - Korean language teachers' attitude as designers (Developer, Evaluator, Practitioner) |

**Table 2.** Elements of curriculum literacy derived from previous studies

| Element | Major content |
|---|---|
| Understanding | - Concept and elements of Korean language curriculum literacy |
| | - Korean language teachers' roles for and attitudes towards the curriculum |
| | -The nature, level, function, system, characteristics, change history of the national-level curriculum (general theory, particulars), related laws, and guidelines for the national-level curriculum (general theory, particulars) |
| | - Nature, goals, content system, achievement standards, teaching and learning methods and evaluation directions of the Korean language curriculum |
| | -Exploration of teacher-level curriculum development methods and cases |
| Practice | - Analyzing classroom context (student characteristics, school and classroom environments, teacher philosophy) |
| | - Interpreting and critically understanding the Korean language curriculum |
| | - Organizing teacher-level curriculum (using curriculum template) |
| | - Developing teaching materials and creating a classroom environment |
| | - Implementing the developed teacher-level curriculum |
| | - Getting feedback about the curriculum (students, teachers) |

Korean language curriculum, and concretely designs integrative teaching/learning and evaluation methods for the Korean language subject areas (listening/speaking, reading, writing, grammar, and literature). In this case, it is also necessary to consider the Korean language materials (discourses, writings, literary works, media texts) and points to note in guidance given the characteristics of the Korean language subject that will be used.

In the development of the integrative curriculum, the principle of integration is important. The central body of the integrated organization is not the acquisition of segmented knowledge within the boundaries of the subject area but is mainly the life of the subject of learning per se, that is, the topics addressed in the subject, social problems or issues, students' problems or matters of interest, topics popular among students, and process-oriented concepts (Beane, 1997; Lee & Park, 2020). In this study, considering the discourse of design thinking, the "problem situations of students in the classroom," which are the target that must be taught by preliminary Korean language teachers in the field, are set as the main organization for the integration of the curricula that will be developed by the teachers. This reflects the fact that design thinking deals with "complex problems."

Third, although preliminary Korean language teachers undertake training on design thinking and develop Korean language curriculum literacy, they may be still experience difficulty when aspiring to high-quality activities. To create an educational environment suitable for program operation, preliminary Korean language teachers are allowed to freely use various educational materials such as textbooks and teacher guides, and equipment such as computers. In addition, the researcher provides periodic feedback to program participants in the process of carrying out project activities so that the activities do not deviate from project goals.

*Object and period of program composition*

The design thinking-based Korean language curriculum literacy program in this study was developed for preliminary Korean language teachers, but it can also be used in classes for incumbent Korean language teachers. Curricula can be developed using various creative problem-solving strategies of design thinking. Whereas the preliminary Korean language teacher may develop the curriculum based on the number of class hours or one textbook unit, the incumbent Korean language teacher may do so based on the semester or grade level. The program can be used to develop not only teacher-level curricula, but also school- or regional-level curricula. The program can be operated for a total of 13 weeks (3 hours per week), as it is most effective and suitable for use in regular classes at teacher training institutions.

*Program development*

In this study, to develop preliminary Korean language teachers' design thinking and a Korean language curriculum literacy program, program development stages and activities were derived as shown in Table 4.

Table 4 shows the results of development of the program operation model by reflecting the implications drawn from the above process. The design thinking-based Korean language curriculum literacy program (improved program) for preliminary Korean language teachers developed in this study is explained by the following stages.

First, for class operation, the program was implemented in a lecture room arranged in the form of a classroom where students could perform and discuss tasks face-to-face so that they could break the existing framework of thinking and immerse themselves in creative convergence thinking and task performance activities. Background music was sometimes provided to create a free atmosphere.

In the orientation stage, the content of the program and the study were explained, and class and evaluation methods were introduced. Team building was carried out through various games to enhance student interest and participation.

In the stage aimed at understanding design thinking and Korean language curriculum literacy, the focus was on helping understanding of related content.

In the stage of developing the 'design thinking-based' Korean language curriculum, preliminary Korean language teachers form teams to carry out a project called "Development of a Korean language curriculum for Korean language-friendly classrooms and student-customized Korean language lessons". Here, students who are targeted for customized Korean language classes are "students who have difficulties in learning the Korean language," who can be easily encountered in school settings. Preliminary Korean language teachers should develop a customized Korean language curriculum to provide Korean language classes for these students.

In the empathizing stage, the teachers carry out in-depth interviews with students experiencing problem situations to find out what problems and difficult situations the students face and empathize with them. After discovering what the problem is, the characteristic of the problem is expressed as a "persona." This is a strategy that analyzes the behavioral pattern of a person experiencing a problem situation to fully appreciate 'who he is, what kind of situation he is in, and what kind of personality he has'. After observing and interviewing problem students who are having difficulties in learning the Korean language, the students' personal information, cognitive, affective, behavioral characteristics, and growth process are summarized.

**Table 4.** Program composition

| Weeks | Stage | Major activities and materials |
|---|---|---|
| 1–2 | Orientation | Introduction of program purpose and overview |
| | | Team building through various games |
| | | Materials: self-introduction activity sheet, team building activity sheet |
| 3 | Understanding design thinking, and Korean language curriculum literacy | View design thinking video |
| | | Understanding design thinking |
| | | Experience all stages of design thinking |
| | | Materials: Online class videos, lecture materials |
| 4–5 | | Understanding Korean language curriculum literacy |
| | | Review and mutual discussion of teacher-level Korean language curriculum development cases |
| | | Materials: Online class videos, lecture materials |
| 6–7 | Reality of design thinking-based Korean language curriculum development | [ Empathizing Stage] |
| | | Empathizing interview activities |
| | | Creating a persona for the interview subjects |
| | | Writing reflection journals |
| | | Materials: [Empathizing Stage] introductory video, expected interview questionnaire, interview log, persona activity sheet, reflection journal |
| 8–9 | | [Problem defining stage] |
| | | 5WHYS (Ohno. 1988), How Might We (Min Basadur 1995) activities |
| | | Problem defining |
| | | Writing reflection journals |
| | | Materials: [Problem defining stage] introductory video, 5 WHYS activity sheet, How Might We? activity journal, reflection journal |
| 10– | | [Idea generation stage] |
| 11 | | Brainstorming |
| | | Categorize idea importance and degrees of execution |
| | | Writing reflection journals |
| | | Materials: [Idea generation stage] Introduction video, brainstorming activity sheet, idea analysis activity sheet, reflection journal |
| 12– | | [Prototype stage] |
| 13 | | Prototype creation |
| | | Writing reflection journals |
| | | Materials:[Prototype stage] introductory video, teaching aids, curriculum templates, reflection journal |
| 14 | | [Test stage] |
| | | Presentation and demonstration |
| | | Mutual discussion within peer group |
| | | Writing reflection journals |
| | | Materials: [Test stage] introductory video, reflection journal, peer evaluation table |

In the problem defining stage, the problem is stated through the "5 WHYS (Ohno, 1988)" and "HMW (Basadur, 1995)" strategies. The 5 WHYS are used to reach an understanding of the essential problem situation or cause by asking "Why?" at least five times. HMW is a thinking strategy to imply what solution would be derived in cooperation with the subject who experiences a problem situation by defining the problem in the form of an abbreviation of "How Might We?" In the empathizing stage, preliminary Korean language teachers deeply understand the student's problem situation, and then concretize the problem as an approach to solving it. For example, it can be defined as "How can we teach students who do not like to read?"

In the problem defining stage, the teachers describe the what the problem is with the 5 WHYS and How Might We? techniques. In the idea generation stage, brainstorming is performed to derive ideas for solving problems using sticky notes. Ideas are refined immediately before the prototype by categorizing them in consideration of the importance and degree of execution of the ideas. In this process, convergent and divergent thinking activities can be experienced in depth.

In the prototype stage, the teachers develop a "Korean language curriculum for a Korean language-friendly classroom and student-customized Korean language classes" based on the results of the empathizing, problem defining, and idea generation stages. Currently, the teachers undergo a free consultation and decision-making process with their fellow prospective teachers. In addition, a "teacher-level Korean language curriculum template" was provided so that the teachers could work on the prototype more easily. For example, strategies such as diagnosing reading ability, visiting a library, conducting a reading workshop, and creating a reading portfolio can be derived.

In the testing stage, prototypes are presented. After the presentation, the preliminary Korean language teachers had time to share their impressions and opinions on the results. An opportunity to hear direct feedback from the teacher who played the role of a student was also provided.

## DISCUSSION

The society of the future demands the cultivation of talented creative convergence individuals, and it is believed that providing education optimized for students based on the national-level curriculum is possible with the curriculum expertise of teachers. This study began from the evaluation that although curriculum literacy is very important for a teacher's curriculum expertise, discussions on it insufficient, and suitable educational programs are not available at the level of teacher education. Since curriculum literacy is the ability to solve complex problems in the educational field by developing a 'teacher-level' curriculum, it shows the possibility of being linked to design thinking. To improve preliminary Korean language teachers' Korean language curriculum literacy this study developed a design thinking-based program.

To that end, the concepts and elements of design thinking and curriculum literacy were first examined in terms of teacher education, and the concepts and elements of Korean language curriculum literacy were reconceptualized. Next, to develop a design thinking-based Korean language curriculum literacy education program, the keynotes necessary for the composition of the program were presented in terms of educational goals, content, methods, and environment, and then the program was developed for accreditation.

However, curriculum literacy and the curriculum expertise of teachers, cannot be nurtured only through one-time training or education. It is not enough to simply know how the curriculum documents are structured and how they have changed. The curriculum literacy of teachers is the professional knowledge of and discerning eye for curriculum components and requires continuous research and implementation experience regarding curricula. In other words, after analyzing and understanding national-level curricula in a practical context, teachers should have the experience of developing and implementing an 'optimized' curriculum for students' learning and growth to fit the classroom context.

Through this study, it is expected that preliminary Korean language teachers will be able to systematically develop the curriculum expertise required of teachers by participating in the Korean language curriculum literacy program of teacher training institutes. There have been few discussions on educational programs for preliminary teachers' curriculum literacy, and this study may contribute to the expansion of related discussions.

In addition, design thinking is spreading not only to teacher education, but also to elementary, middle, and high school education. Studies that discussed the possibility of design thinking at the level of teacher education includeKim et al. (2014); Kim et al. (2018); Lee & Kim (2018) and they are mainly recent studies. The preliminary teachers' educational effectiveness of design thinking was verified in studies conducted by Moon (2018), Seong (2019), Yoon (2019), Hong (2020), and Lee (2020). Design thinking is attracting attention as a future education paradigm, and curriculum literacy, which corresponds to the curriculum expertise of teachers, is an important variable that can affect the quality of education. Therefore, optimal educational models that combine design thinking and curriculum literacy should be proposed and refined.

## CONCLUSIONS

In this paper, the professional practice examined is that of education, specifically, curriculum literacy. i.e., the ability to develop, implement and evaluate curricula. The specific real-world context is developing curriculum literacy in Korean language teachers.

The paper argues that Korean language teachers operate in the real world and therefore need the thinking skills that have a focus on creative solutions, i.e., design thinking skills. However, when viewed from the perspective the children as learners, the problems experienced by children in learning language (both acquisition and literacy) may be derived from cognitive, physical, and emotional issues, particularly in relation to problems with literacy. e.g., dyslexia. The use of the 5WHYS and HMW indicates that some emphasis on the analytic would be appropriate in identifying the root cause of learning problems in language acquisition and literacy.

One of the premises of design thinking is that designers do not start with problems, but an "idea" or "brief" that develops through an iterative and collaborative process and this form of thinking does lead to creative solutions. It therefore does have a place in

PBL programs where creative, innovative solutions are required such as in teacher education. It is useful as part of a program in curriculum literacy, to cause the teachers to examine their own discipline. In this example, Korean language acquisition and literacy, and develop their own views about the thinking processes involved.

In the future, empirical studies on what effects this program brings about in terms of processes and outcomes compared to other Korean language curriculum literacy programs are necessary. In addition, studies on educational environment elements for more effective implementation of the relevant program and studies on teacher competency as facilitators to lead the program smoothly will also be necessary.

## CONFLICT OF INTEREST

The authors declared no conflict of interest.

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1. All manuscripts submitted to Journal of Problem-Based Learning will be reviewed by at least two or three experts in the subject of the manuscript. All submitted manuscripts are subject to peer review on the basis of clarity, scientific accuracy, breadth of appeal, and timeliness. After the process of peer review, the manuscripts will be reviewed by editorial board members and then final decision for publication will be made by Editor-in-Chief of Editorial Committee.
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- ☐ Sequence of title page, abstract and keywords, introduction, materials and methods, results, discussion, references, and tables and figure legends. All pages should be numbered consecutively starting from the title page.
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