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# Preservice Teachers' Confidence and Preferred Teaching Strategies using TeachLivE ™ Virtual Learning Environment: A Two-Step Cluster Analysis

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**ABSTRACT**

TeachLivE™, a mixed reality learning environment originating from University of Central Florida (2011), has recently been introduced to the Australian preservice teaching context by Murdoch University (2016) and the University of Newcastle (2017). This paper, the first of a program of research mapping the implementation of TeachLivE™ within the Australian context, captures preservice teachers' (PSTs) reflections on their initial interactions with the mixed reality learning environment. The study highlights preferred teaching strategies and teaching confidences during initial interactions in the simulation laboratory and introduces a quality measure within the reflective practice process. A Two-Step Cluster analysis of 322 PSTs was conducted. Results showed a positive impact of reflective practice and revealed that most preservice teachers preferred 'Questioning' and 'Direct Instruction' methods of delivering micro-teaching lessons. The authors offer a typology of teaching strategies, confidences and a quality measure for teacher educators.

**Keywords:** mixed methods, reflection, teacher education preparation, technology, teacher beliefs

## INTRODUCTION

The use of simulations is relatively new to the preparation of teachers (Dieker, Lignugaris-Kraft, Hynes, & Hughes, 2016; Kaufman & Ireland, 2016). The first wave of virtual reality within teacher education in Australia was SecondLife™, a 3D simulation recently adopted. A collaborative team led by the public university A academic introduced Second-Life™ as an alternative learning environment between 2010-13 resulting in a government grant to support the implementation of the program. The project produced a series of publications and presentations under the general title VirtualPREX (Masters, Gregory, Reiners, Knox, & Dalgarno, 2013). Studies on the use of Second-Life in initial teacher education programs (Gregory, 2011; Masters & Gregory, 2011) highlight the opportunities and possibilities of technology for preparing preservice teachers.

The focus of this study however is the next generation of mixed reality learning environments *TeachLivE* ™. The TLE TeachlivE™ (Teaching and Learning in a Virtual Environment) is a mixed reality simulation which uses human and artificial intelligence blended innovative environment and puppeteering approach which is controlled by a specialist interactor (TLE TeachLivE, 2017). TeachLivE™ was developed at University of Central Florida to prepare teachers with a range of required skills for being a teacher such as instructional abilities, classroom management, family engagement etc. (Dieker, Rodriguez, Lignugaris- Kraft, Hynes, & Hughes, 2014).

In the TeachLivE™ environment, teachers can practice a skill without putting any student at risk. Because it is a safe environment, this motivates to teachers to use this simulation to hone their skills. Teacher educators can use


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**Contribution of this paper to the literature**

- The paper moves discussions about innovative technologies from '*technology IN the classroom*' to '*technology AS the classroom*'.
- We found that the teaching quality scale yielded an appropriate level of reliability and validity to measure the quality of TeachLivE™ lessons. We also found that most of the preservice teachers used direct instruction and questioning strategies during TeachLivE™ simulations.
- The preservice teachers who preferred to use student-centered teaching strategies had middle level of teaching confidence in one cluster and high level of teaching confidence in another cluster, they were also positioned in a high level of teaching quality in two different clusters and only a low level of teaching quality in one cluster.

TeachLivE™ to provide an effective teacher education and can get immediate feedback with ongoing assessment (Dieker, Lignugaris-Kraft, Hynes, & Hughes, 2016).

The program also allows adapting a series of five behavioral levels in a range for avatars (from calm to out of control one). Four personality types used to create the avatar students' characteristics as aggressiveness and passiveness, and independence and dependency (Hughes et al., 2015). TeachLivE™ is a human in the loop system supported by AMITIES-Avatar- Mediated Interactive Training (Hughes, Nagendran, Dieker, Hynes, & Welch, 2015; Nagendran, Pillat, Kavanaugh, Welch, & Hughes, 2013). The avatars are controlled by an interactor remotely. While avatars have their own skill sets, still they need to be managed to ensure the harmony and consistency in the personalities in a given scenario orchestrated by interactors (Hughes, Nagendran, Dieker, Hynes, & Welch, 2015). Research shows that 10 minutes in the TeachLivE™ simulation environment is roughly equivalent to 45-60 minutes real experience in a classroom environment (Dieker et al., 2014).

The TeachLivE™ technology for Australian initial teacher education programs differs from previous virtual classroom settings such as Secondlife and SimClass in that it involves a 'human loop' in the virtual system, enabling real-time synchronous responses to participants addressing previous asynchronous concerns and restrictions identified in Second-Life implementation. TeachLivE™, a human looped mixed reality learning environment originating from the University of Central Florida in 2011 under the stewardship of Carrie Straub, Lisa Dieker, Michael Hynes and Charles Hughes is currently operating within 75 universities around the globe and has generated over 100 peer reviewed papers on its application in the field of teacher education. Murdoch University introduced TeachLivE™ into Australia in 2016, under the direction of Associate Dean Susan Ledger.

The pilot study yielded positive outcomes and in 2017 was subsequently embedded in all initial teacher education programs at Murdoch University in the West. On the east coast, The University of Newcastle's Dean of Education John Fischetti, spurred by the Universities previous commitment to virtual environments led by Gregory, joined Murdoch University as initial adoptees of TeachLivE™ technologies in Australia. The collaborative research partnership continues to explore and evaluate TeachLivE ™ and its ability to provide initial teacher education programs an alternative method of preparing preservice teachers.

A recent meta-analysis of TeachLivE™ literature (Ersozlu, Ledger, Ersozlu, Mayne, & Wildy, 2018) revealed that the majority of research related to TeachLivE ™ was qualitative, single subject experimental design that predominately relied on surveys and observation tools. The findings also showed that the range of topics were predominately focused on the integration of TeachLivE™ in teacher education and instructional skill development.

In response to adding new knowledge to the current scope of TeachLivE ™ research, this mixed methods study has a combined focus on reflective practice, self-efficacy and lesson quality. Reflective practice processes such as 'micro-teaching' (Allen & Ryan, 1965, 10-14), quality teaching rounds (Gore, 2015) and various manifestations of micro-teaching (Reid, 2011) have long been embedded in initial teacher education discourse.

*TeachLivE*™ and its combination of avatars, virtual simulations and authentic scenarios offer opportunities to facilitate reflective practice processes. It allows participants to observe and reflect on their actions within a virtual context. In this study, *TeachLivE*™ is used as a tool to develop the self-efficacy of preservice teachers (PSTs) by providing a controlled learning environment (laboratory) in which they plan, teach and assess as an aesthetic exercise. The paper moves discussions about innovative technologies from '*technology IN the classroom*' to '*technology AS the classroom*'.

TeachLivE ™ has recently been recognized internationally for its effectiveness and contribution to preparing teaching graduates. However, current authors believe that its full potential has yet to be realized within the context of preparing preservice teachers and also within Australian initial teacher education programs.

This current study maps the initial interactions and reflections of Australian preservice teachers during their first exposure to *Teachlive* ™. The study identifies the preferred teaching strategies used by PSTs, and their personal level of teaching confidence or self-efficacy whilst at the same time attempting to quantify the quality of the

interactions with the class of avatars in a new mixed reality virtual learning environment. To the best of our research knowledge, to date, there is no study that critiques these three features within a simulated or mixed reality learning context. The large sample allowed the exploration of clusters of preservice teachers' engagement with strategies and confidences. The findings provide knowledge on classifications of preservice teachers' competencies, preferred teaching strategies and tools that may be useful for further reflective practice and low risk processes that may improve the quality and capabilities of our future teachers.

## CONTEXT

Universities around the globe continue to prepare preservice teachers for the workforce using traditional approaches and similar programs. Yet, the call for change continues to exist about 'how to best prepare' teachers (Bahr & Mellor, 2016; Le Cornu, 2016; Mayer et al., 2016). Recent attempts to explore alternative approaches to the preparation of teachers include: internships (Foxall, 2014; Ledger, 2017); immersion programs (Tindall-Ford, Ledger, Williams, Ambrosetti, 2018); Teach for America model (www.teachforaustralia.org); Clinical models (McLean-Davies, Dickson, Rickards, Dinham, Conroy, & Davis, 2015); School-based and led initial teacher education programs within the UK (https://getintoteaching.education.gov.uk/explore-my-options/teacher-training-routes/school-led-training/scitt); Observational rounds (Gore, 2015; Mansfield, 2017), and the re-emergence of micro-teaching 2.0.

Ongoing debate also exists about the structure of initial teacher education programs (Darling-Hammond, 2017). Over 30 years ago, Zeichner (1983) offered four paradigms as a way of better designing teacher education programs identifying: *behaviouristic* (observable skills), *personalistic* (developmental approach), *traditional craft* (apprenticeship model under mentor guidance), and *inquiry oriented* (reflective approach to develop efficacy of practice). However, standards based, technical skills driven teacher education models continue to prevail over creative alternatives within schools (Bahr & Mellor, 2016).

More recent systemic directives such as the Australian Institute of Teacher and School Leadership (AITSL) designed *National Professional Standards for Teachers*, *Professional Standards for Initial Teacher Education Programs, and a National Curriculum* are examples of policy led changes occurring in Australia. These documents underpin how current teacher education is promoted, portrayed, measured and designed. Zeichners influence is evident in the construction of the text and acknowledge in the bibliography of the *National Professional Standards for Teachers*. The Standards address three domains; professional knowledge, practice and engagement. It addresses developmental growth through its four career stages; graduate, proficient, highly accomplished and lead teachers. However, the Graduate Standard (GTS) phase does not differentiate for graduates during initial teacher education programs. This has traditionally remained the role of universities through its assessment processes but is currently changing with the development of a *Teacher Performance Assessment*, similar to the model adopted in America. Calling for a more robust assessment regime in Australia of initial teacher education programs, AITSL (Aug 24th, 2017) requires all initial teacher education programs to implement a final year teaching performance assessment that features:

- a reflection of classroom teaching practice including the elements of planning, teaching, assessing and reflecting
- a valid assessment that clearly assesses the content of the GTS
- a clear, measurable, justifiable, achievement criteria that discriminates between meeting and not meeting the GTS
- a reliable assessment in which there are appropriate processes in place for ensuring consistent scoring between assessors
- a moderation processes that support consistent decision making against the achievement criteria.

A recently commissioned report by the Australian Government Department of Education and Training on *Teacher Effectiveness Systems, Frameworks & Measures* (Clinton et al., 2017) highlighted key dimensions of teacher effectiveness from a global sample of 16 countries/states. The review 'points to the premise that teacher effectiveness, in relation to impact and influence, is multi-dimensional and that there are a number of factors that relate causally to these two outcomes' (p.2). It concludes by stating that 'Australian evaluation systems appear to add little value to the enhancement of teaching practice' (p. 149). The review by Clinton et al., (2017) identified common elements across systems and frameworks that define 'effective teaching' as outlined in **Table 1**.

**Table 1.** Effective Teaching (adopted from Clinton et al., 2017)????

| Dimension | Sub-dimension |
|---|---|
| Teaching | Subject matter knowledge |
| | Instructional practice skill |
| | Pedagogical Knowledge |
| | Preparation and planning |
| | Evaluation, assessment and feedback |
| | Learning strategies |

*TeachLivE* ™ offers a virtual context to practice and rehearse many of the dimensions expected of 'effective' pre-service and initial teacher education students (PSTs) outlined in the Graduate Standards (GTS) and **Table 1**. The 'simulation lab', consisting of five avatars in a contemporary classroom setting, presents a safe, low risk learning environment for PSTs to practice and rehearse the science of teaching. A human looped 'interactor' manipulates the five avatars in a similar manner as a 'puppeteer'. Each avatar is personalized in form, voice, and persona, their identities are cognitively and behaviourally modelled on the work of psychologist William Long's (1989) categorization of adolescent personalities. The interactor offers a range of responses catering from compliance level interaction to disruptive [5 levels of behaviour]. This mixed reality simulated learning environment offers initial teacher education programs a controlled, low risk, laboratory setting in which preservice teachers can practice the sub-dimensions of teaching outlined by Clinton et al (2017). This affords PSTs time to reflect on their practice at point of instruction without harming others (Deiker et al., 2016).

The focus on reflective practice or critical reflection, in this study resonates with current discourse highlighting its importance in discussions, debates and literature on teacher education and the preparation of teachers. *TeachLivE* ™ offers an opportunity for point-of-need and real-time reflective practice (Dieker, Rodriguez, Lingnugaris-Kraft, Hynes, & Hughes, 2014). The aesthetic experience provides preservice teachers time to practice and rehearse the art and skill of teaching considered essential in practice theory (Reid, 2011). This unique mixed reality learning context provides lecturers time to judge the quality of their students whilst at the same time developing and supporting their self-efficacy and reflective practice processes.

## TEACHING QUALITY

Teacher quality is a significant predictor of student achievement (Peverly, 2009), however, judging teacher quality is not so easy to predict. Ingersoll (2001, p. 42) stated, 'there is surprisingly little consensus on how to define a quality teacher'. Bahr and Mellor, (2016) found it difficult to judge teacher quality either for preservice and/or inservice teachers. Many measures have been established to try to do so as outlined by Clinton et al (2017). There have been several other measurements developed by researchers for assessing teaching quality, including Dockterman (2017, pp.3-5), who presents 'five different ways to assess teaching quality/effectiveness: (1) value added models: analysis of student achievement data, (2) classroom observations: collecting data during teaching practice by watching, (3) portfolios: analysis of students works and teacher lesson plans, (4) student surveys: assessing perceptions of students, (5) teacher surveys: teachers self-report measures'. Many of these elements are currently embedded in Australian national standards and assessment procedures.

Marzano (2012), suggests that 'an evaluation system that fosters teacher learning will differ from one whose aim is to measure teacher competence', adding, 'teacher evaluation systems have not accurately measured teacher quality and have not aided in developing a highly skilled teacher workforce' (p.14-15). If this is the case, and if we want to improve teacher educators and associated research on teachers' quality and effectiveness, then reflective practice may hold the key to improved practice and quality.

However, quality remains an elusive construct. Bahr & Mellor (2016) conclude their '*Building quality in teacher education report*' by offering an equation on how to improve initial teacher education (ITE) programs: 'Quality = (competencies + productive behaviours) X personal attributes'. They argue that ITE 'programs should develop pre-service teachers' personal attributes and values at the same time as they hone their competencies for teaching' (p.64). This concept of quality correlates with Zeichners' original focus on personality and the recent push for identifying and measuring the non-cognitive domains of preservice teacher applicants in Australian Higher Education initial teacher education programs.

Although teacher education programs need to increase the coursework and field experiences to train good quality teachers (Welsh & Schaffer, 2017), attention rests on the intersection of coursework and field experiences; namely, teaching strategies. If effective teachers or teachers of excellence engage their students actively by using different teaching strategies in their classrooms (Darling-Hammond, 2010), it is important that preservice teachers have a range of teaching strategies in their professional repertoire from which to draw upon. Additionally, reflective practice provides a critical tool for self-improvement, providing the preservice teacher a process for

choosing the most appropriate action (teaching strategy, management approach, engagement method) from their repertoire of options to suit context specific incidents.

## TEACHING STRATEGIES

A wide range of teaching strategies or instructional strategies exist for teachers to access and apply within class settings (Bennett & Smilanich, 1994; Cruikshank, Bainer, & Metcalf, 1999; Currier, 2001; Merrill, Jones, & Li, 1992). Teaching strategies can be classified generally into four commonly used teaching methods:

> *didactic* (direct teaching; e.g. lecture or presentation); *modelling* (direct teaching; e.g. demonstration or practice); *managerial* (indirect or interactive teaching, facilitation, individualization and group management); and *dialogic* (indirect interactive teaching; questions and thought provocations), (Petrina, 2007; p. 93).

A simpler classification bifurcates strategies into 'teacher-centred' and 'student-centred'. Teacher directed instruction is a traditional approach where teachers control the learning process (Schunk, 2008). Student-centred instructional methods are constructivist in nature and actively engage students in their learning. The teachers often act as a facilitator in the process and provide help to students whilst they construct their knowledge. There is no right or wrong instructional method. Indeed, using both teacher- centred and student-centred approaches increase effective teaching (Kyriakides, Christoforou, & Charalambous, 2013). However, researchers have shown that there is a relation between approach to teaching and the quality of student learning outcomes (Trigwell, Prosser & Waterhouse, 1999; Gore et al., 2016). More recently, evidence is building that more innovative teaching methodologies outperform the traditional classroom teaching (Khurshid & Ansari, 2012).

The *Australian Society for Evidence Based Teaching* recently analysed the work of Robert Marzano and John Hattie and both showed agreement on what they considered to be the eight most 'powerful' teaching strategies:

1. **A Clear Focus for the Lesson** -lesson goals; teacher clarity.
2. **Offer Overt Instruction** –teacher controlled; scaffolded learning; explicit teaching.
3. **Getting Students to Engage with the Content** –active engagement built on prior; knowledge; questioning recall; taxonomies.
4. **Give Feedback** –immediate; focused.
5. **Multiple Exposures**- enhance exposure to internalize information; practice, rehearsal and review.
6. **Have Students Apply their Knowledge** –general principle/concept applied to specific case studies or problems.
7. **Get Students to Work Together** – cooperative learning; informed participants
8. **Build Students Self-Efficacy** – confidence; achievement; praise; relationships.

Marzano (2012) measures the art and science of teaching using 41 strategies and behaviours grouped similarly to Zeichner (1983); 'routine strategies, content strategies and strategies enacted on the spot'. He draws distinction between measurement and development within teacher evaluation suggesting both serve different purposes and in so doing warns of the impact on teachers' self-efficacy or confidence.

## TEACHING CONFIDENCE

Teaching confidence can be defined as preservice teachers' confidence about their ability to teach a subject from the lenses of social learning theory (Bandura, 1977). Confidence in one's teaching competence, can also be described as one's self-efficacy (Christensen, Knezek, Tyler-Wood, & Gibson, 2011). There is a positive correlation between teaching practices and teaching efficacy expectations (Berger, 2010). When teachers perceive their content and pedagogical knowledge as being high they tend to have a high sense of confidence or self-efficacy (Sadler, 2009). It has been shown that beginning teachers' preparation for effective teaching is related to their teaching confidence (Darling-Hammond, Chung, & Frelow, 2002, Tschannen-Moran, Hoy, & Hoy, 1998).

Tschannen-Moran and Woolfolk Hoy (2001) state that teacher's sense of self-efficacy have three mechanisms: self-efficacy for *student engagement*, self-efficacy for *instructional strategies*, and self- efficacy for *managing classroom*. The self-efficacy for student engagement refers to teacher's self-confidence to engage students in learning. The self-efficacy for instructional strategies refers to teacher's self-confidence to use different teaching methods effectively. The self-efficacy for managing classroom refer to teacher's self-confidence to control students unwanted behaviours and to sustain the behaviours under control to produce a secure place for all students feel comfortable. Preservice teachers require experience and practice in these three elements and currently they are only afforded within real class settings.

Self-efficacy for teaching has an impact on both teacher's own skills and also on their students (Klassen et al., 2009). Considering the importance of self-efficacy initial teacher education programs must attend to the development of self-efficacy of preservice teachers through a diverse range of methods that address engagement, teaching strategies and classroom management skills explicitly. TeachLivE ™ has been presented as an alternative learning environment that provides a safe, low risk context in which these skills can be developed.

## IMPROVING TEACHING QUALITY THROUGH TeachLivE SIMULATION

From 2012, the beginning of TeachLivE™ research, to date, over 130 research papers, presentations and thesis have been completed. Most of them were about integrating TeachLivE in teacher education programs to increase teaching effectiveness of preservice teachers. Some were related to self-efficacy skills in TeachLivE™ simulations (Elford, 2013; Regalla, Hutchinson, Nutta, & Ashtari, 2016; Scheuermann & Page, 2016; Uludag-Bautista & Boone, 2015) and a small number of studies targeted honing preservice teachers' pedagogical practice and teaching skills (Enicks, 2012; Lewis, 2016; Peterson, 2014; Sander, 2014) through TeachLivE simulations. Uludag-Bautista and Boone (2015) examined the impact of TeachLivE™ on preservice early childhood teachers' understanding of inquiry-based science and self-efficacy beliefs. The results suggested that TeachLivE™ helped preservice teachers improve their understanding and confidence related to teaching science. Similarly, Sander (2014) examined how preservice teachers learn to teach in an inquiry-oriented way in TeachLivE™ simulations. Results suggested that TeachLivE™ has the potential to elicit the prior knowledge of preservice teachers regarding learning to teaching. Lewis (2016) evaluated if use of questioning sequence, from high to low questions, impact on preservice teachers reading comprehension using TeachLivE™ simulations. The results revealed that after using TeachLivE™ simulations preservice teachers effectively improved their use of socratic questioning. Elford (2013) examined pre- and in-service special educator's perceptions, efficacy, and attitudes toward using TLE TeachLivE™ as a practice tool for literacy instruction strategies. Results showed that all participants agreed that TeachLivE™ simulations had a positive impact on their experience and confidence. Peterson (2014) investigated the effect of TeachLivE™ simulations on improving use of instructional strategies of preservice special education teachers. Results supported the continued use of TeachLivE™ as an effective tool for preservice special education teachers.

Research has shown that 10 minutes in the TeachLivE™ simulation environment is roughly equivalent to 45-60 minutes of experience in a real classroom environment (Dieker et al., 2014). Research has also evidenced that targeted behaviour of teachers can changed in four, 10 min sessions in the TeachLivE™ simulation environment (Straub, Dieker, Hynes & Hughes, 2014).

Ashtari, (2016) examined the impact of TeachLivE™ simulations on teacher candidates sense of self-efficacy. Their study revealed that there was no significant difference between the pre-survey and post survey scores of self-efficacies of preservice teachers who participated in simulation classroom experience. Scheuermann and Page (2016) examined preservice teacher's perceptions on teaching in TeachLivE ™ simulations and the results suggested four overall trends in teacher's confidence providing a typology showing; upward, downward, level and a combined down followed by an upward trend of improvement.

The vast majority of studies to date, suggest TeachLivE ™ does have a positive impact on the preparation of preservice teachers. Enicks (2012) examined if there was a relationship between participation in TeachLivE™ and teaching effectively in practicum settings for special education preservice teachers. Results indicated that TeachLivE™ is an effective tool to develop effective teaching behaviours. It is from this premise, a commitment to reflective practice and the opportunities that TeachLivE™ affords preservice teachers, that underpins the impetus for this study.

## RESEARCH QUESTIONS

The purpose of this study was to capture and classify preservice teachers' (PSTs) preferred teaching strategies and teaching confidences in conjunction with their levels of teaching quality while interacting in TeachLivE™ simulations. We sought the following questions:

1. What teaching strategies do preservice teachers use during TeachLivE™ simulations?
2. Does the Teaching Quality scale developed in this study yield an appropriate level of reliability and validity?
3. What Preservice teacher profiles emerged from cluster analysis using the variables of Preferred Teaching Strategy, Teaching Confidence (lowest, low, middle and high) and Teaching Quality?

## METHODOLOGY & METHODS

In this study, we adopt a mixed method approach to capture and provide a more rigorous understanding of (Creswell & Plano Clark 2007) the components of quality, teaching practice and confidence of preservice teachers

interacting with TeachLivE™. In terms of qualitative analysis, we used content analysis to identify the teaching strategies that preservice teachers reported while they interacted within the TeachLivE™ simulation. Our quantitative analysis, incorporated descriptive statistics, factor analysis, item analysis and a two-step cluster analysis to interrogate the data. We used correlation coefficients to see the convergent and divergent validity of the measures as an evidence for construct validity.

The two-step cluster analysis is used to reveal natural groupings within the dataset. Our method is unique because it prevails the traditional cluster analysis in two ways. The first, is our method allows us to consider both categorical and continuous data. The second, is the two-step cluster analysis determines the number of clusters automatically.

## PARTICIPANTS

First-year preservice teachers across all initial teacher education programs were invited to participate in the TeachLivE™ study. Participation was voluntarily and included early childhood, primary and secondary four-year Bachelor of Education programs and two-year Master of Teaching degrees. Each student planned, delivered and reflected on a 10-minute micro-teaching session conducted in a designated simulation room or via skype using home computer or laptop. The skype interactions allowed all of the cohort opportunity to participate in the study not only those on campus. The mixed reality learning environment consisted of five avatars, each with their own persona across a range of personality types within a middle year setting. The avatars responded with a high compliance level of behaviour appropriate to the needs of first year preservice teachers. A total of 322 preservice teachers representing 82% of the total cohort of first year initial teacher education programs in the School of Education at the public university B took part in the trial.

## DATA TOOLS

### Teaching Strategy Tool

Students were asked to plan a micro-teaching lesson to deliver in the TeachLivE ™ learning environment based on their own choice of content and strategies. In order to collect preservice teachers' preferred teaching strategy used during the TeachLivE™ simulations students were asked a series of structured questions, the first being "Outline what teaching strategy you focused on in this micro-teaching session?" Student responses were run through a content analysis to reveal emerging general themes based on valid inference. When creating themes, authors focused specifically on the teaching strategy used by preservice teachers. Six emerging themes were, "Direct Instruction", "Questioning", "Collaborative Learning", "Active Learning", "Classroom Management", "Not Use Any". Two independent academics from the educational sciences field collated the data and identified relevant themes and on completion compared them. The differences and similarities between educational scientists' categorization were calculated using Miles and Huberman (1994) formula to determine inter-rater reliability "Reliability level=Agreement/Agreement+Disagreement".

One of the researchers identified three data under three different categories (Questioning, Collaborative learning and Active learning) the other identified (Direct Instruction, Active learning, Questioning). A high reliability level was revealed 322/(322+3)=0.99. After discussing the possible classification for these different categorizations, a consensus was reached on six identified themes. Researchers coded the themes from one to six and entered them associated with their original order into the SPSS program in preparation for statistical analysis.

### Teaching Confidence Tool

In order to determine preservice teachers perceived teaching confidences we asked them to answer the question "How confident did you feel in relation to teaching in the TeachLivE™ simulation lab?" by rating their confidence levels according to a 4 level Likert scale from "not at all" to "very confident". To achieve a reliability coefficient of this single item scale we used a test-retest reliability technique. We administered the scale two different times to the same participants and used the Pearson correlation coefficients to determine the reliability.

There was a moderate positive (.520, $p < .01$) relationship between the two measures. Preservice teachers perceived teaching confidence levels were respectively "not at all (n=21, 6.5%), "somewhat confident (n=38, 11.8%), "confident (n=159, 49.4%), and "very confident (n=104, 32.3%). According to descriptive statistics, we labelled each case as "lowest" (value of means is 1), "low" (value of means is 2), "middle" (value of means is 3), and "high" (value of means is 4) level confidences.

**Table 2.** Pearson Correlations of Teaching Strategy, Teaching Confidence, Lesson Delivery Quality, Rapport Building and Teaching Quality (N=322)

| Measures | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Teaching Strategy | - | | | | |
| 2. Teaching Confidence | .129* | - | | | |
| 3. Lesson Delivery Quality | .058 | .494** | - | | |
| 4. Rapport Building | .112* | .421** | .826** | - | |
| 5. Teaching Quality | .078 | .490** | .983** | .916** | - |

*$p < .05$. **$p < .01$.

## Teaching Quality Scale (TQS)

In order to determine the teaching quality of preservice teachers' performance during TeachLivE™ simulations we created a 20 item 'qualities of teaching' survey using a 5 Likert self-report scale from "not met" to "exceeds" based on work by Marzano (2016), Hattie (2014), and Gore (2016). The variance ranged from highest score of 100 and lowest of 5 points. To develop the Teaching Quality scale (TQS), first we examined the factorability of TQS using correlation coefficients. Second, we used the Kaiser-Meyer-Olkin (KMO) to measure the sampling adequacy and Bartlett's tests to test of sphericity. We used Principal Component Analysis with Varimax Rotation technique to run the factor analysis. For the reliability analysis, we calculated Cronbach Alpha coefficients and Item-Total correlations. Results revealed that TQS had a two-factor solution. The first factor had 14 items and second factor had 6 items. We labelled the factors according to the context of its' items including: Factor 1 'Quality of TeachLivE™ Lesson Delivery' and "Rapport Building" for Factor 2 (see **Table 1**).

# RESULTS

We present the findings in two parts. First, in response to the validity of measures and second in response to the research questions.

## Convergent and Divergent (Discriminant) Validity of Measures

As a part of construct validity of our measures we used Pearson Correlation analysis to see how much the measurements were related. It should be noted that the correlations between theoretically similar constructs should be "high" (convergent validity) while the correlations between theoretically dissimilar constructs should be "low" (discriminant validity).

As the evidence of discriminant validity, the results of analysis showed that there were "low" correlations between "Teaching Quality" with its sub factors as "Lesson Delivery Quality", "Rapport Building" and "Teaching Strategy" measurements. The "Teaching Confidence" was found to be relatively small (near to moderate) with the measures of "Teaching Quality" and its sub factors. However, as this correlation coefficient is still relatively small, it does not show the questionable discriminant validity. As the evidence of convergent validity, the results of analysis revealed that there were "high" correlations between "Teaching Quality" and its sub factors as "Lesson Delivery Quality" and "Teaching Quality". The correlation coefficients suggested that the measurements have both good and acceptable convergent and discriminant validity levels.

## What teaching Strategies are Used by PSTs during Teachlive ™ Simulation?

The results from the content analysis focusing on what teaching strategies the preservice teachers used during TeachLivE simulations revealed that most preservice teachers preferred to use "Questioning" (37%) and "Direct Instruction" (30%) when delivering the micro teaching lessons. A small number of preservice teachers stated that they didn't use any strategy (4%) or they preferred to not answer the question asked about their strategy (6%). The remaining strategies were proportionately distributed as follows: active learning approach 12%, classroom management technique 3% and collaborative learning approach 9% (see **Figure 1**).

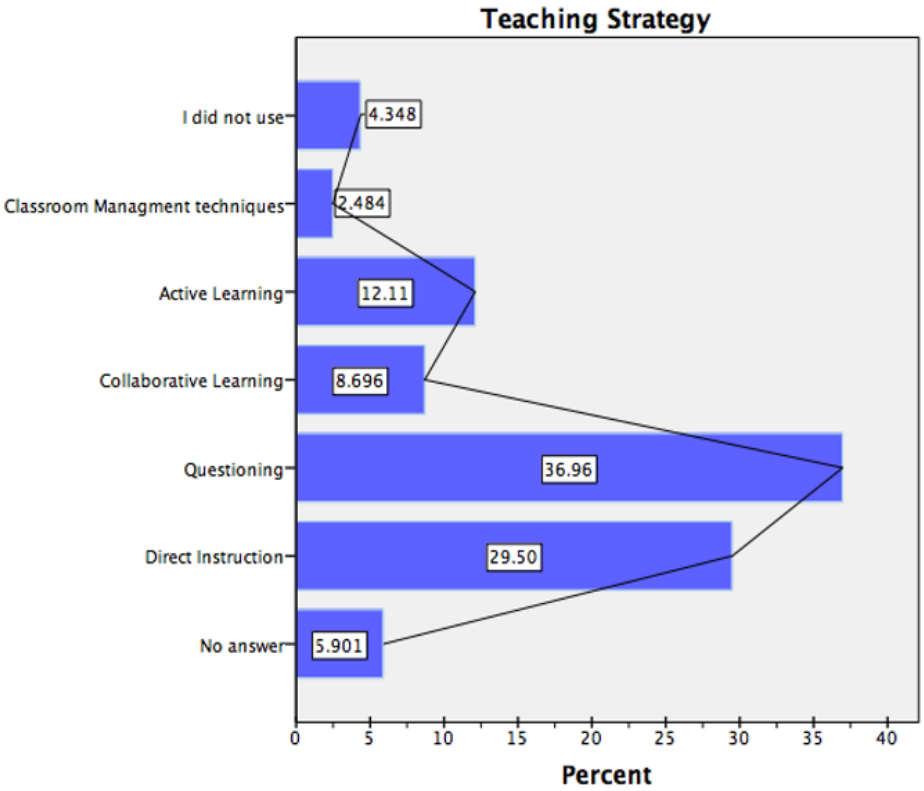


**Figure 1.** The Percentages of Preferred Teaching Strategies During TeachLivE™ Simulations

## Does the Teaching Quality Scale Developed in this Study Yield an Appropriate Level of Reliability and Validity?

The TQS yielded reliability and validity results. The positive correlations between 20 items changed between below of moderate level as .411 and above of moderate level as .760. There was also positive and high correlation between Factor 1 and Factor 2 as .826.

Kaiser-Meyer-Olkin (KMO) were found to be .967 which shows this scale can be factorable and Bartlett's tests and 4968.498 ($p<0.000$) was significant. The results of factorability analysis showed that TES was suitable for the factor analysis with its 20 items. TES Principal Components Analysis, Kaiser Normalization, and Varimax Rotation were employed to identify the factor structure of TES. The factor analysis results showed that the TQS has 2 factor solutions with an eigenvalue bigger than 1. The two-factor solution explained 64.983% of total variance. While the first factor explained 59.601%, the second factor explained 5.381% of the total variance. The two-factor solution showed a range of Commonalities between .575 and .752. We can conclude that the two-factor structure explained the majority of the total variance. The factor loads for the first factor (14 items) changed between .588 and .778; and it changed between .592 and .844 for the second factor (6 items) (see **Table 3**). The Cronbach Alpha and Item-Total Correlation coefficients performed sorted out the reliability of TES. The overall Cronbach Alpha coefficient for the whole scale was .964 and the Item-Total Correlation coefficients differed between .644 and .794. Results for the factor and reliability analysis showed that TES has high reliability and validity to measure of TeachLivE™ lessons quality.

**Table 3.** Factor Loadings and Dimensions of Teaching Quality Scale

| Factors | Items | Factor Loadings |
|---|---|---|
| Factor 1<br>*Quality of TeachLivE Lesson Delivery (α=.955)* | Presence | .721 |
| | Effective Introduction of Topic | .750 |
| | Sustained exploration/communication | .778 |
| | Conclusion/clarification of students | .713 |
| | Gaining attention/interest | .742 |
| | Dialogic engagement and questioning | .739 |
| | Appropriate responses to students | .723 |
| | Able to maintain interest | .760 |
| | Voiced tone and expression | .605 |
| | Vocabulary appropriate and situation specific | .680 |
| | Able to question to draw out knowledge | .651 |
| | Responds to questions | .588 |
| | Clearly articulates expectations through Positive reinforcement | .660 |
| | Able to redirect off-task behaviours | .634 |
| Factor 2<br>*Rapport Building (α=.898)* | Eye contact | .642 |
| | Use of names | .844 |
| | Interaction with each avatar | .770 |
| | Positive and smiling | .759 |
| | Clear and Audible | .617 |
| | Body language (grounded, open, appropriate) | .592 |

## What Preservice Teacher Profiles Emerged from Cluster Analysis using the Variables of Preferred Teaching Strategy, Teaching Confidence and Teaching Quality?

Because, this current study has both categorical and continuous data we used Two-Step Cluster analysis in SPSS 21.0. Cluster analysis identifies homogenous groups of objects which in a specific cluster differ from other objects that don't belong to this specific cluster (Mooi & Sarstedt, 2011). Firstly, the Two-Step Cluster analysis identifies the pre-clusters similar to the k-means algorithm, then it uses hierarchical agglomerative clustering technique to classify them sequentially to form homogenous clusters. Furthermore, the Two-step approach automatically choose the number of clusters and decide importance levels of variables by calculating Akaike's Information Criterion (AIC) or Bayes Information Criterion (BIC) (Mooi & Sarstedt, 2011). Secondly, the procedure distinguishes the largest distance between two nearest clusters. We used log-likelihood distance coefficients for the variables (Melia & Heckerman, 1998) and Bayes Information Criterion (BIC) to determine the importance levels of variables in the clusters.

The continuous variable was Teaching Quality measures and the categorical variables were teaching confidence and preferred teaching strategy usage in this study.

We examined the multicollinearity issues (Hair et al., 1998) before performing the Two-Step Cluster analysis to make sure that the variables did not have higher correlations with the other variables to increase the variance of the coefficient estimates. We calculated the Tolerance (T) and Variance Inflation Factor (VIF) value for each of the case. The tolerance values were found between 0.79 and 0.99 and the VIF coefficients were found between 1.009 and 1.261 which show acceptable range of multicollinearity among the variables. We also examined the Skewness and Kurtosis tests to see if there are any values which exceed the normality of distribution. The z-values of the variables revealed that for the teaching confidence (skewness: 0.818, kurtosis: 0.328), for the teaching strategy usage (skewness: 0.982, kurtosis: 0.615) and for the teaching quality (skewness: 0.059, kurtosis: -0.467). None of the variables exceeded the1.96 which is acceptable range for Kurtosis test and the -1 to +1 which show the best range for Skewness.

Before performing Two-Step Cluster analysis, we also made sure that there were significant differences between variables. We used one-way ANOVA to check if there were any significant differences. The results revealed that the effect of teaching quality on preferred teaching strategy was significant, F (6, 315) = 6.076, p=.000. Post hoc analyses using the Tukey test for significance showed that preferred teaching strategy usage during simulations differed significantly. The preservice teacher who stated that "no answer" was significantly lower (M= 53.526, SD=3.172) in Teaching Quality than in "classroom management techniques" (M=73.250, SD=5.320), in "collaborative learning" (M=70.428, SD=3.751), in "active learning" (M=67.435, SD=3.53), in "direct instruction" (M=64.800, SD=3.172), and in "questioning" (M=62.9328, SD=3.118). The preservice teachers who stated "I did not use" was also significantly lower (M=54.642, SD=4.440) in Teaching Quality than in "classroom management

**Table 4.** Summary of Clusters

| Cluster Numbers | Teaching Confidence | Teaching Strategy | Teaching Quality |
|---|---|---|---|
| Student-centred, high teaching quality with middle level of confidence | Middle | Active Learning | High |
| Teacher-centred, low teaching quality with middle level of confidence | Middle | Direct Instruction | Low |
| Teacher-centred, low teaching quality with low confidence | Low | Direct Instruction | Low |
| Student-centred, high teaching quality with high confidence | High | Questioning | High |
| Student-centred, low teaching quality with middle level of confidence | Middle | Questioning | Low |

techniques" (M=73.250, SD=5.320), "collaborative learning" (M=70.428, SD=3.751), and "active learning" (M=67.435, SD=3.531).

We also analysed the effect of teaching quality on teaching confidence during simulations which was significant F (3, 318) =34.786, p=.000. The results of Tukey test as Post hoc analysis showed that the preservice teachers who have "low" level of teaching confidence were significantly lower (M=50.952, SD=12.897) in Teaching Quality than in "middle" (M=62.635, SD=11.707), in "high" (M=72.105, SD=11.286). The preservice teachers who had "low" level of teaching confidence were also lower (M=54.921, SD=10.473) in Teaching Quality than in "middle" and "high" levels. The "middle" level of teaching confidence was lower (M=62.635, SD=11.707) in Teaching Quality than in the "high" level (M=72.105, SD=11.286).

The Two-Step Cluster analysis indicated that a five-cluster solution was the best model for a fair cluster quality. The large ratio of BIC changes and distance measures show better cluster solutions (see **Table 2**). The centroids also showed that the clusters are separated well by the continuous variable which is Teaching Quality (see **Table 3**).

The 61 cases were given in the first cluster (18.9%), 76 cases to the second (23.6%), 55 cases to the third (17.1%), 68 cases to the fourth (21.1%) and 62 cases to the fifth (19.3%) (**Figure 1**). The largest cluster was the second cluster with 76 cases while the third cluster of 55 being the smaller cluster of cases.

The most important predictors for cluster membership were Teaching Confidence (1.0) and Teaching Strategy (.94), followed by Teaching Quality (.15). In the first cluster, the teaching confidence was middle, the teaching strategy was active learning and teaching quality was above median with 68.13.

The first Cluster was labelled as "Student centred, high teaching quality with middle level of confidence" (**Table 4**), (N=61, 18.9%). The preservice teachers who were in this cluster had middle level teaching confidence (N=33, 54.09%) and used active learning as a teaching strategy (N=35, 57.37%) and also had teaching quality levels (M=69.30, SD=13.20) above the median (68.13) considered as a high level of teaching quality.

In the second cluster, the teaching confidence was captured as "middle", the teaching strategy as "direct instruction" and teaching quality as "below median" with a 59.95. The Second Cluster was labelled as "Teacher-centred, low teaching quality with middle level of confidence" (**Table 4**), (N=76, 23.6%). The preservice teachers who were in this cluster had middle level teaching confidence (N=64, 84.21%) and used direct instruction as a teaching strategy (N=42, 55.26%) and had also teaching quality levels (M=62.53, SD=12.15) below the median (59.95) considered as a low level of teaching quality.

In the third cluster, the teaching confidence was "low", the teaching strategy was "direct instruction" and teaching quality was "below median" with a 51.99. The Third Cluster was labelled as "Teacher-centred, low teaching quality with low confidence" (**Table 4**), (N=55, 17.1%). The preservice teachers who were in this cluster had low level teaching confidence (N=34, 61.81%) and used direct instruction as a teaching strategy (N=25, 45.45%) and had also teaching quality levels (M=53.91, SD=11.73) below the median (51.99) considered as a low level of teaching quality.

In the fourth cluster, the teaching confidence was "high", the teaching strategy was "questioning" and teaching quality was "above the middle level" with a 71.56 median. The Fourth Cluster was labelled as "Student-centred, high teaching quality with high confidence" (**Table 4**), (N=68, 21.1%). The preservice teachers who were in this cluster had high level teaching confidence (N=68, 100%), used questioning as a teaching strategy (N=40, 58.82%) and had also teaching quality levels (M=71.43, SD=10.55) above the median (71.56) considered as a high level of teaching quality.

In the fifth cluster, the teaching confidence was "middle", the teaching strategy was "questioning" and teaching quality was "below middle level" with a 60.60 median. The Fifth Cluster was labelled as "Student-centred, low teaching quality with middle level of confidence" (**Table 4**), (N=62, 19.3%). The preservice teachers who were in this cluster had "middle" level teaching confidence (N=62, 100%) and used "questioning" as a teaching strategy (N=62, 100%) and had also teaching quality levels (M=61.52, SD=11.42) "below the median" (60.60) considered as a low level of teaching quality.

The clustering results suggested that the preservice teachers who preferred to use student centered teaching strategies had middle and high level of teaching confidence and they were in a high teaching quality level in two

**Table 5.** Results of Auto-Clustering

| Number of Clusters | Schwarz's Bayesian Criterion (BIC) | BIC Change[a] | Ratio of BIC Changes[b] | Ratio of Distance Measures[c] |
|---|---|---|---|---|
| 1 | 2047.482 | | | |
| 2 | 1774.040 | -273.442 | 1.000 | 1.135 |
| 3 | 1540.587 | -233.452 | .854 | 1.327 |
| 4 | 1380.389 | -160.199 | .586 | 1.090 |
| 5 | 1238.614 | -141.775 | .518 | 1.613 |
| 6 | 1174.864 | -63.750 | .233 | 1.362 |
| 7 | 1144.958 | -29.906 | .109 | 1.100 |
| 8 | 1123.511 | -21.446 | .078 | 1.277 |
| 9 | 1120.506 | -3.005 | .011 | 1.158 |
| 10 | 1126.584 | 6.078 | -.022 | 1.090 |

[a.] The changes are from the previous number of clusters in the table.
[b.] The ratios of changes are relative to the change for the two-cluster solution.
[c.] The ratios of distance measures are based on the current number of clusters against the previous number of clusters.

**Table 6.** Results of Centroids

| Clusters | Mean | Standard Deviation |
|---|---|---|
| 1 | 69.30 | 13.20 |
| 2 | 62.52 | 12.15 |
| 3 | 53.90 | 11.73 |
| 4 | 71.42 | 10.55 |
| 5 | 61.51 | 11.42 |
| Combined | 64.02 | 13.20 |

different clusters and in a low teaching quality level in only one cluster. Those preservice teachers in the teacher centered clusters, were low teaching quality levels in both two clusters but they had a middle level of teaching confidence in one cluster and a low level of teaching confidence in the other cluster.

We examined the cross tabulation of the clusters across the variables. Findings from cross tabulation of teaching strategy across the clusters suggested that the some of the members of the first cluster used a collaborative learning strategy (42.6%) while most of them used active learning strategy (57.4%). In cluster two, 15.8% of members had given no answer to strategy question while 10.5% of them stated that they had used classroom management strategies. 18.4% of them stated that they did not use any strategy following most of them stating that they have used direct instruction (55.3%). In the third cluster, pre-service teachers had given no answer to strategy question while 3.6% of them stating that they used collaborative learning, 7.8% have used active learning and 30.9% have used questioning strategy following most of them stating that they have used direct instruction (45.5%). In the fourth cluster, 41.2% of the preservice teachers stated that they had used direct instruction and 58.8% of them had used questioning. In the fifth cluster, %100 of the pre-service teachers stated that they have used questioning strategy.

The cross-tabulating of teaching confidence across the clusters yield 45.9% of the preservice teachers within cluster one had "high" 54.1% or "middle level" of teaching confidence. In cluster two, 5.3% of the preservice teachers had low level, 10.5% of them had high and 84.2% of them had middle level teaching confidence. In the third cluster, 100% of the preservice teachers had low level teaching confidence. In the fourth cluster, 100% of the pre-service teachers had high level of teaching confidence. In the fifth cluster, 100% of the preservice teachers had middle level of teaching confidence.

## DISCUSSION

In this mixed-method study, we used a range of quantitative tools and qualitative processes to examine pre-service teachers preferred teaching strategies and teaching confidences associated with their teaching quality during TeachLivE™ simulation classroom teaching experience.

First, we found that most of the preservice teachers used direct instruction and questioning strategies during TeachLivE™ simulations. Next, we found that the teaching quality scale yielded an appropriate level of reliability and validity to measure the quality of TeachLivE™ lessons. Finally, we were able to classify the preservice teachers according to their usage of teaching strategy, their teaching confidence and teaching quality while using TeachLivE™. We conclude that there were two basic cluster groups regarding teaching strategy usage; teacher-centred and student-centred. The preservice teachers who preferred to use student-centred teaching strategies had middle level of teaching confidence in one cluster and high level of teaching confidence in another cluster, they

were also positioned in a high level of teaching quality in two different clusters and only a low level of teaching quality in one cluster.

### Student-Centred Clusters

The preservice teachers who preferred to use student-centred strategies already had middle and above middle teaching confidence. They also had a high level of teaching quality in most of the clusters. We know that teacher's confidences affect thinking, behaviour and motivation levels (Pajares, 1996) therefore the findings of this current study are aligned with previous findings in the field. We can conclude that effectiveness of teaching is closely related to their teaching confidence (Darling-Hammond, Chung, & Frelow, 2002; Tschannen-Moran, Hoy, & Hoy, 1998). If teachers perceived their content and pedagogical knowledge were high then they felt their confidence high (Sadler, 2009).

### Teacher-Centred Clusters

The preservice teachers who were low in teaching quality levels in two clusters, had a middle level of teaching confidence in one cluster and a low level of teaching confidence in the other. Research suggests that teachers with high confidence in their teaching ability, also have a high level of student centeredness and the teachers with a lower level of confidence in their teaching ability, similarly have a lower level of student centeredness (Postareff, Lindblom-Ylänne & Nevgi, 2007).

This clustering analysis presents a profile of pre-service teachers' interactions with TeachLivE ™ from an Australian initial teacher education program perspective. Most Australian preservice teachers (PSTs) used direct instruction and questioning as teaching strategies during simulations. These two strategies are common in both preservice and in-service teachers (Cruikshank, Bainer, & Metcalf, 1999; Currier, 2001; Merrill, Jones, & Li, 1992; Schunk, 2008; Petrina, 2007). However, student-centred strategies, considered more effective than teacher centred approaches because they engage students in the learning (Catalano and Catalano, 1999) were less prevalent in the delivery of TeachLivE ™lessons.

Another interesting finding from this study relates to some clusters having 100% of preservice teachers with either high or low teaching confidences. For example, in the third cluster 100% were teacher-centred with low teaching quality; in the fifth cluster, student-centred with low teaching quality, 100% of the preservice teachers had middle level teaching confidences; in the fourth cluster (student-centred with high teaching quality) 100% of them had high-level confidence and they tended to use student-centred strategies. Also of interest, when pre-service teachers had a low level of confidence they tended to use teacher-centred teaching strategies, and they also had low teaching quality perceptions.

Confidence levels of preservice teachers evoke a wider usage of teaching strategies. Lesson study, microteaching and reflective practice all contribute to developing a repertoire of teaching strategies for preservice teachers in current initial teacher education programs (Conroy et al., 2015). However, TeachLivE ™ has the capacity to value add to this process. It has been found to be an effective tool to improve teaching competencies as well as increasing positive teaching confidence (Elford, 2013; Regalla, Hutchinson, Nutta, & Ashtari, 2016; Scheuermann & Page, 2016; Uludag-Bautista &Boone, 2015).

## LIMITATIONS

A range of limitations exist within this study that we attempted to counterbalance with methodological solutions or pragmatic ones. The current study used reflective practice to self-report on their TeachLivE™ simulation experience. Much concern exists in regard self-reporting and scales (Fan et al., 2006), however, the authors aware of inbuilt biases chose the most effective and efficient approach that would not allow preservice teachers time to formulate desired responses but rather capture immediate reactions of their interactions. Although only the 'after' TeachLivE ™ reflections were reported in this paper, comments and videos have also been captured before, during and after the inaugural Australian group of students' engagement with TeachLivE ™. The self-reporting scales used to measure teaching confidence and quality levels will be used with the observations and videos to validate the scales. In addition, the data from this study allowed us to instigate pre and post data collection points in future studies using the categories that emerged from the two-step cluster analysis. Future research could investigate the relationship between teaching strategy tendency and teaching confidence to see if there are causal relationships.

Our study profiled preservice teachers' teaching competencies and confidences after using TeachLivE™ simulations. However, given that the participants were all first-year students future research may investigate if there are any differences in typologies of the preservice teachers before and after using simulations. Capturing more demographics about participants would yield previous life experiences and knowledge of teaching strategies.

Additionally, to investigate whether TeachLivE™ simulations have any effect on increasing teaching competences regarding teaching strategy usage and increased confidence would benefit from taking place across at least three sessions of simulations and/or before or after a real classroom experience. In our study, we did not directly look for the prediction analysis, so future research could explore the range of explanations within the variables.

One of our findings suggested that the teaching quality scale (TQS) covered general teaching competences and it is a reliable and valid in this size of the sample. Future research may adopt the scale for bigger samples and perhaps in different areas.

## CONCLUSION

Practice theory and reflective practice combine to target teaching strategies, confidences and teacher quality in this study. It has revealed a typology of clusters based on preferred teaching strategies and confidences of first year preservice teachers and a teacher quality scale (TQS). "The key to this [practice theory] is ensuring student teachers can actually study and 'practice' teaching, bringing into existence in their own bodies the capacity to develop expertise on the basis of experience" (Reid, 2011, p.308).

Finding suitable opportunities to practice teaching can be problematic in initial teacher education courses. Consideration of the importance of reflective practice and feedback is reflected in Hattie's (2012) concern that novice or struggling students need immediate feedback, Gore's (2016) belief, that teaching practice becomes more effective when students are stimulated to engage in their learning process actively, Marzano's (2012) focus on timely feedback while there is still time to improve and Reid's (2011) focus on the importance of studying and practicing teaching as an aesthetic exercise.

The study shows that TeachLivE ™ technologies provides an alternative to real classroom experiences for preservice teachers to 'practice and rehearse' the art and science of teaching and in turn improve quality teaching that has only ever been addressed, valued or measured during real classroom experiences. Many characteristics and abilities predict teaching effectiveness and need to be observed (Darling-Hammon, Wei, & Johnson, 2009). TeachlivE ™ provides a context to observe teacher characteristics and abilities "first hand" which is rarely afforded in university settings, particularly with increasing numbers of online teacher education programs.

The findings reinforce the usefulness of TeachLivE™ in preparing preservice teachers for real life contexts however, the authors believe that its full potential has yet to be realized within the context of Australian initial teacher education programs. A combination of practice theory, reflective practice and simulation afford possible solutions to better preparing future teachers to increase self-efficacy, teaching strategies and quality. A call for further exploration of mixed reality learning environments in initial teacher education is recommended, with a specific focus on teaching strategies and teacher preparedness.

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