Experiencing Clay: Inquiry-based Learning and Assessment for Learning

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ABSTRACT:

This article presents an examination of the effects of using an inquiry-based learning pedagogy to teach ceramics to pre-service teachers (my students) at the Hong Kong Institute of Education. At the beginning of the study the students were asked to conduct experiments on the properties of clay. The results indicate that half of them were able to transfer the knowledge and inquiry skills they had acquired from the experiments to their subsequent artwork production, but that the other half could not. I realized that the students needed more guidance to bridge the gap between their initial inquiries and their subsequent artistic creations. This could be done by explaining clearly the objectives of the inquiry-based learning activities; employing strategies of assessment for learning: that is, setting explicit assessment criteria; involving the students in self-assessments; and focusing more on methods of knowledge transfer and ways of bringing about improvements.

INTRODUCTION

In 2003 the Hong Kong visual arts curriculum guide suggested using inquiry-based learning and other pedagogies to facilitate the assessment for learning. It is believed that inquiry-based learning can motivate students to learn, develop their thinking skills and enhance their understanding (Curriculum Development Council, 2003, 38). However, not many studies on these pedagogies have been conducted in Hong Kong, except the one recently published by Ng (2009), nor have many studies on the learning of ceramics-making been carried out.

The idea of assessment first appeared in the Hong Kong visual arts curriculum in 1995 under the name ‘evaluation’. It was believed that by means of evaluation both the student’s performance and the quality of teaching could be improved. The ideas of ‘self-evaluation’ and ‘formative evaluation’ were introduced. The concept of ‘formative evaluation’ was defined as ‘assessing students’ work continuously within a certain period of time’ and ‘keep[ing] a record of their performances in doing each assignment so that *an average mark* [my emphasis] is obtained at the end of an academic year’ (Curriculum Development Council, 1995, 32-33). Its focus was on the modes of assessment. Little attention was paid to the relationship between the assessment and the teaching and learning process. In 2002 the new arts education curriculum moved from obtaining a student’s ‘average mark’, to ‘formative assessment’: that is, to ‘diagnose strengths and weaknesses and to improve students’ learning’, as well as ‘to assist the teacher to plan the next step’ (Curriculum Development Council, 2002, 79).

Review of current practice

After teaching pre-service art teachers for more than twenty years I find that most of the pre-service teachers are used to the technique-based learning style of making ceramics and they find it very difficult to think or work in alternative ways. This might be owing to their past training and preconceived ideas about ceramics. To my knowledge ceramics teaching in Hong Kong is usually technique-based and teacher-centred and students' learning is usually measured by how they perform in creating their final artwork: that is, through summative assessment. Little attention is given to the learning process or their extended learning, the emphasis being solely on their ceramics production.

Hopes and concerns incorporated into the new practice

In view of the narrow scope of ideas generated by many pre-service visual arts teachers (my students) and their technique-orientated way of working, I attempted to use the inquiry-based learning pedagogy to extend their experience to alternative methods of working and at the same time nurture their self-learning skills in making art. In this study the students were engaged in some self-exploratory activities so that they could discover new knowledge by themselves. Alongside this learning process, assessments were introduced to help students learn and improve their work. It was hoped that by acquiring the skills necessary for self-exploratory work they would generate some unconventional ideas and subsequently develop more mature ceramic work.

REVIEW OF LITERATURE

Inquiry-based learning

Inquiry-based learning is regarded as important in the learning process (James & Pedder, 2006). The goals of inquiry are to prepare students to be inquirers, problem finders, problem solvers, thinkers who can find meaning on their own, learners who are able to rely on themselves to acquire new knowledge (Aulls & Shore, 2008, 23). Four properties of inquiry have been identified: process, content, strategy and context. The process of inquiry 'involves making observations, posing questions, examining books and other sources of information to see what is already known, planning investigations, reviewing what is already known in light of experimental evidence, proposing answers and explanations and communicating results' (The National Education Standards, 1996, 23, cited by Aulls & Shore, 2008, 145).

The content of investigations provides opportunities for students to reflect, and so their understanding of particular concepts will be developed. The students must choose their own strategies and plan their actions in order to solve any problems they have identified. The teacher must create a context which will facilitate students' inquiry learning by providing the necessary resources and opportunities to apply new knowledge (Aulls & Shore, 1999, 12, cited by Rejskind, Halliday & McBride, 2008, 249).

In order to break away from the over-reliance on existing skills and techniques Dewey (1934, 144) suggested using experiments to initiate the creative process. Through experimentation, an artist can 'open new fields of experience and disclose new aspects and qualities in familiar scenes and objects' (p.150). Dewey identified three stages of development when attempting to express a particular experience as an art form. In the first stage, a new technique is adopted through experimentation; the second stage involves absorbing the new procedure and modifying an 'old tradition', and in the last stage a normalization and execution of the newly acquired technique in new forms and expressions takes place (p.147). In this way the imaginative and sensory awareness of an individual is heightened, with meaning being derived from that individual's circumstances and a connection being made to 'a larger remembered and projected individual history of striving and attainment' (Haskins, 2003, 105).

Assessment for learning

The Qualifications and Curriculum Authority (QCA) in England states:

> Assessment for learning involves using assessment in the classroom to raise pupils' achievement. It is based on the idea that pupils will improve most if they understand the aim of their learning, where they are in relation to this aim and how they can achieve the aim (Qualifications and Curriculum Development Agency (QCDA), 2009).

This definition focuses on students' improvement and the relationship between this improvement and their understanding of, and adherence to the aim of their learning. Key characteristics of assessment for learning identified by the QCA are: 'using effective questioning techniques; using marking and feedback strategies; sharing learning goals; peer and self-assessment'. Effective assessment for learning involves:

- sharing learning goals with pupils;
- helping pupils know and recognize the standards to aim for;
- providing feedback that helps pupils to identify how to improve;
- believing that every pupil can improve in comparison with previous achievements;
- both the teacher and pupils reviewing and reflecting on pupils' performance and progress;
- pupils learning self-assessment techniques to discover areas they need to improve, and recognizing that both motivation and self-esteem, crucial for effective learning and progress, can be increased by effective assessment techniques. (QCDA, 2009).

Effective assessment for learning requires a change in pedagogical practice; a modification of teachers' and students' classroom roles and norms of behaviour; new understanding of the

nature of teaching and learning; and new attitudes to and practice of learning and teaching, with critical and reflective modes of participation. The new roles learners should adopt involve: understanding the learning goals, understanding how and what they are learning, identifying the criteria for assessing progress, developing approaches to learning, reflecting on their learning, and developing skills in assessment for further improvements. The learning process should involve peer and self-assessment, reflecting on previous learning, analysing and evaluating problems, planning for new learning, and self-regulation (James & Pedder, 2006, 27, 28, 30, 40).

The relationship between inquiry-based learning and assessment for learning

Both inquiry-based learning and assessment for learning demand students' active participation in the learning process. The former emphasizes the generation of new knowledge by means of systematic investigations, while the latter focuses on seeking evidence for assessment and making improvements.

METHODS

This was a case study with the focus on how pre-service teachers learned ceramics when an inquiry-based learning pedagogy and assessment for learning were employed. The subjects in this study were the second-year pre-service teachers (my students) enrolled in the Art Academic Major Study, which is part of the full-time Bachelor of Education Programme at the Hong Kong Institute of Education. The module to be examined was the *Ceramics* module. There is no similar module offered as part of this course. This module was taught by me and was conducted weekly in ten three-hour sessions. The research was completed in 2006 with 14 students (10 females and 4 males) taking part. Nine students were interviewed after the teaching was completed and their responses were studied through qualitative analysis.

I adopted Dewey's (1934) three stages of development in the design of the ceramics teaching used in this study: that is, experimentation, absorbing new procedures, and application in a new context. In the first stage the students were required to conduct experiments in groups by working according to the stated procedure. In the second stage they repeatedly used the same procedure of exploration as in the first stage with the focus moved to studying the relationship between clay and other materials. In the second exploration exercise their traditional practices of working by watching the teacher's demonstration and then building up ceramic forms according to the teacher's instruction were modified. In the third stage they organized their experiments according to their own individual needs by following the same working procedure.

Peer assessment was conducted after a given task had been completed. Students were asked to present their findings, followed by a critique. It was expected that they would be able to solve problems with the help of the other members of the peer group and eventually

develop their skills and understanding. The teacher's feedback was given by marking the worksheets and students' portfolios.

Research design and rationale

The theme of the students' project in this study was "Materials and Ceramics". It was intended to stimulate their thought regarding the relationships between ceramics and other materials.

As stated above, in this study three stages of development were involved. The first stage was the experimental stage. In this stage the students used self-exploratory techniques in conducting experiments in order to learn about the properties of clay. It was hoped that this knowledge and experience would later be transferred to the students' final ceramic artwork production. The second stage involved absorbing the new procedure. The students investigated the relationships between clay and other materials by adopting the working procedure employed in the first stage. The third stage was the application stage. During this stage the students selected their own topics and conducted further explorations into the properties and forms of clay according to their own needs before they finalized their artwork design.

Learning took place through a process of systematic discovery and assessment. The cycle of learning was as follows: (1) instructions and guidelines were given by the teacher (as supplied in the worksheet); (2) students' participation in the prescribed activity; (3) students' verbal presentation, class discussion in which the results of the experiment were analysed (peer assessment and self-reflection); (4) teacher assessment (students' learning extended after receiving feedback given by the teacher; (5) students' self-reflection, followed by the next cycle of learning. The effect of presenting their results was to clarify in the minds of the students what they had actually done. Since the students had all participated in different kinds of experimental activities they were also teaching their peers about their practical experience and the new knowledge they had acquired. The feedback they obtained from their peers helped them to reflect critically on their experience.

The first stage

The first set of experiments took place in the first session. The students were asked to conduct experiments into the general properties of clay: for instance, to notice the various characteristics clay possesses in its material cycle (e.g., slip, 'leather-hard' clay or 'bone-dry' clay) and also its states in relation to plasticity, shrinkage and so forth. Questions such as (using slip, 'leather-hard' clay or 'bone-dry' clay) 'What happens if water is continuously added to a piece of clay?' 'What happens when you join two pieces of clay together using water or slip?' 'What happens when you use a hairdryer to dry the clay?' were asked. According to my experience beginners in ceramics tend to add too much water to the clay

surface, making the clay forms collapse. Sometimes they try to join pieces of dry clay together and consequently they split apart. In normal practice ceramics teachers instruct beginners by stating the dos and don'ts. In this study I allowed my students to conduct these experiments by themselves so that they could become aware of the problems through personal experience. On the other hand, these problems may also give rise to creative possibilities: for example, cracks may appear when slip is dried rapidly, which may be seen as a problem. However, if one wishes to create a clay surface which has cracks in it, this is the way to do it.

The students worked in pairs. Each pair was given a different experimental focus. A worksheet was given to the students to guide them in recording the learning process, analysing the results, and considering possibilities for further applications (see Figure 1). This experiment provided practical experience so that the students could acquire the basic skills of inquiry-based learning. After completing the explorations, they had to give a verbal presentation of their results and their peers had to comment on these results: that is, peer-assessment was conducted. The worksheets were then submitted to the teacher who wrote her comments and provided supplementary information about the clay experiments. These marked worksheets were returned to the students before they conducted the second set of experiments in the second session (see Figure 2 for the criteria of assessment used for experiment 1).

Figure 1: Items listed on the worksheet on clay experiments

Focus of experiment	Working procedure	Result of Experiment		Difficulties encountered and points to be observed	Possible methods of application	Photographic record
		Surface effect	Form			

Figure 2: Criteria for the assessment of experiment 1

The criteria used for the assessment of experiment 1 were the students' ability to:

- work according to the given instructions;
- observe and record the changes in the clay during the process of work;
- identify the properties of clay and any problems that arose, as well as to explain why these occur;
- discover alternative ways of working, and
- suggest possible solutions and ways to make use of the resultant effect.

The second stage

The second set of experiments was carried out in the second session. Students were asked to investigate the relationships between clay and other materials. These relationships included integration (when clay is mixed with another material), replacement (when another material is used as a substitute for a particular clay form or structure) and replication (when clay is used to imitate another material). Mixing or adding other materials to clay is a recently developed ceramic technique. For example, the Hong Kong artist, Sara Tse (Tse Shuk Ting), in *Attire* (2002; see Hong Kong Museum of Art, 2003, 86-87) made use of this technique to produce a set of ceramic works by dipping clothes into porcelain slip. In this study, precautions were taken to prevent students mixing hazardous substances into clay. The students were restricted to the use of natural materials for this experiment. When the clay was dry it was then fired. Some groups were asked to use other materials to substitute part of a clay form: for example, using metal wire to make the stand for a pot. Some groups were asked to use clay to imitate other materials: for example, rocks or cloth. All the groups were required to record the process and results of the clay work on a worksheet (the same as the one shown in Figure 1). The assessment of and feedback on the previous experiment provided a practical example of how to conduct inquiry-based learning. Extending the same items of inquiry into the new context helped students reinforce their skills in inquiry-based learning and thus enhanced their learning-to-learn ability. A peer assessment and teacher's assessment were conducted (see Figure 3 for the criteria used for the assessment of experiment 2).

Figure 3: Criteria for the assessment of experiment 2

The criteria used for the assessment of experiment 2 were the students' ability to:

- discover ways of mixing different materials into clay or the integrative use of another material with clay;
- observe and record the textural effect of adding different kinds of materials to clay and their effects after being fired;
- observe the textural surfaces of materials and develop ways to imitate these textures;
- identify any problems that arose, and
- suggest possible ways of using the effects of these problems.

The third stage

In the third stage, the students were required to generate ideas and produce a piece (set) of ceramic work(s) relevant to the theme of "Materials and Ceramics". They had to conduct experiments on forms related to a chosen material other than clay before finalizing their thematic artwork. They were also required to submit a portfolio containing records of the experiments they had conducted and the process of work, together with analyses and

reflections. Before submission, peer assessment was also involved (see Figure 4 for the criteria used for assessment of the final artwork and portfolio).

Figure 4: Criteria for the assessment of the final artworks and portfolios

The criteria used for the assessment of the final artworks and portfolios were the students' ability to:

- transfer the knowledge and skills they had acquired in the early stage of development to their final artwork production;
- extend their skills in inquiry-based learning to their own selected topic of study;
- perceive the relationship between certain materials and clay and manipulate these materials in ceramic work;
- reflect on the form design and working process, and suggest possible improvements.

Nine students were interviewed after the teaching was completed. The major interview questions included:

1. In this module which learning strategy do you think was the most effective?
2. What are the differences between the pedagogies used in the modules and those which you experienced in your secondary schooling, as well as those you have been used to?
3. What motivates you to use self-reflection and self-learning?
4. What else have you learnt from this module other than ceramics skills?
5. How do you feel about this module?

The responses were used as evidence of the effect of inquiry-based learning and assessment for learning.

RESULTS AND DISCUSSIONS

Guidance required at the initial stage

During the early stage of experimentation the students seemed to be at a loss as to how to start, so I dipped a lump of dry clay into water and asked them to describe what they saw. The students then seemed to grasp what I meant and proceeded to their work independently. Occasionally I gave some advice in response to a query: for example, confirming a suggested method of mixing other materials into the clay. The teacher's worksheet seemed to be an effective means of guiding their learning. A student stated during the interview:

> *The teacher's worksheet was very useful. Without it we would not have recorded details of our explorations. Moreover, when we did our final artwork we were able to refer to this record. It reminded us of particular effects and working considerations.* (Karen) (all names are aliases)

Inquiry gains

Academic outcomes

The term ‘inquiry gains’ refers to the benefits derived from inquiry-based learning in terms of ‘personal-affective, social and academic outcomes’, such as ‘increased higher order thinking, subject-matter understanding, more extensive knowledge and teamwork’ (Aulls & Shore, 2008, 15). The students’ responses in this study supported this definition, indicating advancement in their thinking and inquiry skills. Generally speaking, their reports on their experiments in the portfolios were detailed (see Figure 9). This reveals that the students were able to manage their self-learning. They were able to select relevant and diverse materials to be mixed with the clay. These included grass, rice, sawdust, woodchips, sand, string, paper and metal wire. These materials were either placed on top of the clay surface or mixed into the body of the clay (see Figure 5).

Figure 5

<table>
<tr><td colspan="2">mixing rice into clay, greenware
mixing rice into clay, biscuit fired</td><td>Rice placed on the clay surface;</td><td>Rice embedded into the clay</td></tr>
<tr><td>Student’s description</td><td colspan="3">When fired the rice on the surface of the clay vaporized;
The fact that the top layer of the clay split might have been because of the air pressure produced when the rice inside the clay vaporized.</td></tr>
</table>

The constructive effect of experimentation

Some fifty per cent of the students were able to extend their experiences of working with clay and other materials to their thematic work. As seen from their portfolios, the experiments conducted by the students involved the following: (1) integration of other materials into clay: for example, putting pins into porcelain ears to symbolize the irritating effect of hearing something unacceptable (see Figure 6); (2) mixing other materials into the clay: for example, painting slip onto a paper origami aeroplane (see Figure 7); (3) imitation of a particular material by manipulating the properties of clay: for example, using the slip to make icing for cakes, or to create cracks to simulate a dry earth surface by drying slip rapidly, and (4) imitation of other materials: for example, balloon, knife, bark of trees, film strips, wings, paper scrolls of musical scores and a cartoon box (see Figure 5). They were able to describe the conditions necessary in order to produce particular effects; the effects of and limitations on mixing different materials into clay; the technical problems encountered and their causes; the possibilities of artistic expression arising from the integration of different materials, and related safety matters. They were able to observe the time constraints imposed by the plasticity of clay; technical requirements and working procedures in the building of form, and possible risks when firing the clay. An example of a student’s report can be seen in Figure 9. This detailed description demonstrates the constructive effect of ‘experimentation’, as proposed by Dewey. The student’s personal tactile experience of materials had enhanced

her knowledge and understanding of the properties of clay and other materials.

Figure 9: A student's report on making a clay balloon (extract from the student's portfolio) outlining method used and difficulties encountered. English translation

(a) Prepare a piece of 0.5 cm thick clay slab.
(b) A balloon was filled with water. The balloon was covered with clay slab apart from the lip.
(c) A hairdryer was used to dry the clay until it was leather-hard (cracks appeared at the rim).
(d) The balloon was broken, the water poured out and the rubber balloon extracted.
(e) The clay was dried further.
(f) Some soft clay was used to repair the cracks.
(g) A paddle was used to smooth the shape of the balloon by patting the clay surface.
(h) A sponge was used to soften the area on which it was intended to make a punching effect. This area was pressed in a circular direction. Some clay was added during the process because the clay slab might be too thin and a hole might result.
(i) The lip was made into the shape of a knot by modeling and
(j) stuck onto the balloon body using slip.
(k) Little holes were punched around the lip to serve as air passages during the firing process.
(l) Six balloons were produced.

Difficulties encountered:
(a) it was difficult to fix the lip firmly onto the balloon;
(b) cracks often appeared during the drying process;
(c) the need constantly to revolve the clay balloon, and
(d) patting the ball shape was very time-consuming

As seen from Wendy's portfolio, in her initial exploration, she discovered the textural effect that could be achieved by impressing different materials onto the surface of the clay: for example, branches. She then extended her explorations to other materials, such as leaves and petals, and to different forms. She also made use of various visual references at different stages to enrich her artwork. The tree trunk teapots of a Taiwanese artist, Huang Shi Tian, inspired her ideas on the relationship between man and his environment. Wendy made use of the skills she had learned in a number of different explorations to create a sense of decay in her thematic work by imitating bark texture found in the environment and created a cracked texture by drying slip rapidly. Throughout the process she continuously refined her ideas and

skills by means of further experiments and through reflections. During the interview Wendy described the change in her learning style and attitude:

> *In my previous ceramics learning (that is, in my secondary school education) I usually worked according to the teacher's instructions, step by step. I seemed to have been controlled, especially in the development of my ideas. Now I am given plenty of creative space with the support of a relevant foundation [skills and knowledge].*
>
> *I think we need to explore by ourselves, to experience the material, to learn how to master the relevant skills and to search for relevant information. During this process we can generate some creative ideas.* (Wendy)

In the interviews other students also expressed the change in their attitude towards learning:

> *We can work according to our own ideas. We can carry out experiments from different perspectives… In the past I was reluctant to listen to alternative opinions. Through this learning process, I have learnt to be more open to criticism. If I had the opportunity I would conduct more experiments to improve my work, as I did when experimenting with the colour and texture of the ceramic 'paper box' I had made… I feel the need to carry out further experimentation.* (Charles)

> *At first I thought it would be easy to put my ideas into practice. However, when I started working many problems emerged… Now I often review the working process to see what mistakes I have made and how to correct them. I think my attitude in learning has changed. I have adopted the self-learning attitude. This should not be regarded as having been because of the influence of my teacher; rather, it was the properties of clay that led me to adopt this new attitude.* (Peter)

These examples show that the students were aware that learning by conducting experiments requires modifications in learning style: that is, a movement towards self-learning.

Personal-affective and social gains

During the presentations in the peer assessment exercises, most of the students were passive. They seldom voiced their opinions or asked questions and they were reluctant to criticize others. Sometimes the teacher needed to prompt the discussion or call out particular students' names in order to elicit responses. Despite this fact some students indicated that their learning could be extended by viewing other people's examples. Their portfolios show that some of them made cross references to others' experimental results. In the interview one student described her personal-affective gains as follows:

> *In the beginning I felt very frustrated about what to do. After consulting the teacher and conducting some experiments by myself I realized that what I needed to do was to generate some ideas by myself instead of copying others' work.*
>
> *I derived much satisfaction and gained in self-confidence, because, by means of various experiments, I discovered many new techniques which were used by artists. This learning approach also involves a lot of experiences of failure, which is something I have been used to. The discovery process demands the help of the teacher and the technician. Discussions and sharing with peers may also help. I know what I have learned when I recall my past experience.* (Wendy)

It appears that the students were able to make use of and take pleasure in the inquiry-based learning. Information gathered from the students' portfolios revealed that 42.9 per cent of them had analysed their experiments in clay and its relationships with other materials. 35.7 per cent of them had carried out extensive explorations before finalizing their artworks.

Inquiry barriers

Students' expectations of ceramics learning

However, some 'inquiry barriers' were observed. As defined by Aulls and Shore, the term 'inquiry barriers' refers to 'factors that students believed might limit inquiry learning or preclude them from participating in inquiry learning' (Aulls & Shore, 2008, 15). For example, in the interview one student who favours technique-based learning said:

> *We should place more emphasis on basic skills: for example, the skills involved in throwing a bowl, which should be thin, even and glazed… Without learning [throwing] skills, the learning of ceramics becomes meaningless.* (Lily)

Ceramics learning is commonly associated with training in skills. Lily was highly influenced by her preconceived concepts about the necessity for knowledge and skills to be taught by the teacher, rather than being interested in new ideas and new ways in which students could learn by themselves as associated with the concept of inquiry-based learning.

Students' reluctance to carry out inquiries or experiments

Nearly half of the students concentrated solely on the form associated with their chosen theme. They were not able to proceed to the stage of absorbing a new procedure and using the newly acquired technique in new forms and expressions as suggested by Dewey (1934), because they could not see how to apply what they had learned in the initial stage to the subsequent stage. Some students were reluctant to carry out inquiries or experiments prior to the final artwork production: that is, to transfer their learning to the next stage. This may be

illustrated by Nick's comments during the interview:

> *I don't know how many experiments are needed and the criteria for assessment in this exercise. I don't know how to show that I have learned something through the experiments.*
>
> *It was a waste of time and it reduced my motivation to work. The teacher should have focused more on the skills I used to produce my final piece of artwork and not on the skills I learned from my experiments.*
>
> *I seldom conducted experiments for the sake of experiments. After I had generated an idea, I usually focused on the most appropriate method for making it and then I proceeded to create the work straightaway. I would do the experimental work afterwards [this is the reverse order of the teacher's instructions] so as to fulfill the requirements of the assignment.*
>
> *I have learned some basic ceramics skills in my secondary schooling. I don't wish to do so much repetitive work. I do not think the experimental work is useful. The process of making the final piece of work is itself an experimental work. The effect of experimentation is limited. It is not worth spending any time on it.*

Students' adherence to summative assessment and neglect of the learning process

The fact that Nick focused solely on the summative assessment is significant. He neglected the learning acquired during the learning process and was reluctant to follow the inquiry-based learning approach. This is related to his belief that explorations are not beneficial to his artistic creation. It also arises from his misconception that experimentation leads only to the acquisition of basic skills, rather than being an in-depth aesthetic and conceptual investigation. This is the antithesis of the objectives of inquiry-based learning and assessment for learning mentioned above. The above example indicates that the students' preconceptions about exploration and ceramics learning can become obstacles to using the inquiry-based learning approach. The students' reluctance to elaborate on their initial explorations had limited the scope of their understanding of the qualities of clay and its relationship with other materials, as well as of the diverse effects on form and texture which might lead to a more creative and mature mode of expression.

CONCLUSION

It appears that the students derived some inquiry gains from this study. These included acquiring inquiry skills from observation and reporting on the working process. Many of them were able to conduct further investigations which helped in the creation of their final artwork by employing the inquiry skills learnt from the initial experiments. They became more open-minded about considering alternative ideas. They were able to see that the use of this learning approach might involve much trial and error and realized the necessity for

changing their attitudes and roles in learning. They thought that the teacher's individual and written guidance were necessary for this learning approach.

However inquiry barriers were also seen. The students' preconceived concepts about ceramics learning and their resistance to changing from their existing learning style to the new mode of learning became obstacles to the implementation of inquiry-based learning. In the inquiry learning process, answers are not prescribed or predetermined. Unexpected results may lead to the further refinement of skills or ideas. Some students lost these opportunities for advancement owing to their lack of awareness of such opportunities.

The results reveal that it is not only teachers but also students who need to change their understanding, values, attitudes and behaviour. The students' view of learning as simply the acquisition of knowledge and skills should be changed to a view of learning as participation, and the process of learning should be regarded as equally important as the product of learning. The teacher must convince students of the beneficial effects of inquiry-based learning and assessment by making explicit the aim of learning during the different stages of development, and help the students to adopt the new roles relevant to this learning approach. Moreover, peer assessment also helped the students to share ideas, although they need more practice in order to become used to doing so. The introduction of self-assessment throughout the learning process with timely feedback from the teacher is also necessary so that students become more interested in their progress, rather than focusing solely on their summative assessment results. In order for it to be more effective, the objectives of inquiry-based learning and the criteria for assessment should be clearly explained at the early stage of the students' learning and discussions on how reflective practice could improve students' subsequent work should be conducted more frequently. The results of this study reveal that the use of assessment strategies could facilitate inquiry-based learning. Using both learning theories together might have a multiplying effect. More study on this aspect is necessary.

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