Examining Vocational Teachers’ Online Video-Based Reflective Practice Regarding Guided Discovery Learning Instruction

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Abstract. It is important for vocational teachers to master pedagogical knowledge and skills of using various strategies and methods in teaching as well as professionally improving performance through continuous reflective practice. The purpose of this multiple-case study was to describe Indonesian vocational teachers’ nature in performing reflection activities using the iCRT online video-based annotation tool. Six participants were selected from three different vocational high schools and paired into three groups of subject lessons. Their nature in performing reflection activities regarding guided-discovery learning instruction were examined by analyzing the dynamic interaction between selective attention and knowledge-based reasoning (framework adapted from Sherin, 2007). The results found that the iCRT system can be employed to identify the specific stage of instructions has taken the most noticed event involved most of teachers’ intervention in providing instruction and the improvement of teaching practice can be seen from how teachers reasoned on the selective part of the teaching scene. Another result was that the iCRT system was also proven could help teachers in recognizing their strengths and weaknesses in providing guided discovery learning instruction.

1. Introduction

Jay & Johnson (2002) claimed that “One of the most powerful tools in effective teaching is the presence of a well-defined image of what is to be learned.”. This argument leads to the importance of reflection in teaching because no doubt, that effective teachers should continually seek out the best ways to improve their teaching practice, and reflective practice aids such improvement.

Most of educators who have interest in reflective practice will give acknowledge to John Dewey (1933) as the first person who proposed reflective practice. As cited in Jay & Johnson (2002);
Tripp & Rich (2011); and Jones (2014); John Dewey defined reflection as "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends". While Hawkins & Rogers (2016); Jones (2014), revealed that some developed countries, such as the United States, Australia and the United Kingdom, have set professional standardized for teachers which included reflective practice as one of teaching practice and defined reflective practice within the context of teaching as teachers who continually evaluate the effects of their choices and actions on others (students, parents, or other professionals in the learning community) and who actively seek out opportunities to grow professionally. Reflective practice will guide teachers to gain insights or problems or issues within their practice.

Associated with Dewey's opinion, there is an intellectual process during reflection. The reflective teachers, according to Valli (1997); Lougahan (2005), can look back on some events of their teaching practice experience, evaluate them, make adjustments as well as improvements on their teaching behavioural based on professional belief, research, or ethical knowledge. Nevertheless, particularly in Indonesia, reflective practice of in-service teachers, especially vocational teachers, is poorly implemented although essentially, the reflection process plays an important role in improving teacher professionalism (Suratno & Iskandar, 2010).

Furthermore, to enhance teachers’ motivation for conducting reflective practice is by using video analysis tools (Gaudein, C. & Chaliès, S., 2015). Research has shown that the use of video technology which allowed to capture classroom practice in authentic way with additional features, such as play and pause, has provided much influence and support for teachers’ reflection processes (Seidel et al., 2011; Grossman, P. L., 2005), unlike the regular classroom teaching supervision. Moreover, as the advance of technology and the need for more authentic and verifiable of self-analysis reflection tools are increasing, a variety of video annotation tools emerge which offer the potential to support self-reflection activities as well as the ability to analyze teaching practices, collaboratively (Rich & Hannafin, 2008; Sherin & Van Es, 2005). The purpose of this study was to gain an in-depth understanding of how the online-video based annotation tool can assist vocational teachers in performing reflection activities as well as using their ability to notice and analyze the sequences of learning regarding guided-discovery implementation.

1.1. Technology supported reflective practice

One way of helping teachers in promoting their reflective practice is through the support of video-based technology. Various studies (Sherin & van Es, 2005; Tripp & Rich, 2011; Tripp & Rich, 2012; Rich & Hannafin, 2009) have explained how video has been employed and utilized in the practice of teachers’ professional development and effectively proven as a tool for encouraging and supporting reflective practice. Gaudein & Chalies (2015) have reported the significant benefits of using video in reflective practice for professional developments, among others:

(1) Heightened teachers’ motivation. Video can be an effective tool for promoting reflective practice. It has ability to record the classroom interaction permanently, to paused and rewind so the segments can be reviewed on multiple occasions, with different perspectives each time if one desires. Those benefits enabled teachers to choose specific segments to view based on a particular goal (van Es & Sherin, 2002). Research on Individual reflection through video shown high emotional and motivational involvement of participants and positive changes in teachers’
noticing abilities. While, reflecting to others’ video teaching may allow for more detached result. (Kleinknecht & Scheneider, 2013)

(2) Optimized selective attention and knowledge reasoning. Evaluations of video-based professional development have focused primarily on the cognitive processes of selective attention and knowledge-based reasoning. And the studies have shown that video-based professional development allows teachers to improve their ability to notice and interpret important features of classroom interactions as well as influences viewers motivationally and emotionally in ways that text does not (Sherin, 2005; Seidel, et.al, 2011).

(3) Improved classroom practice. In reflection activities, classroom videos will activate prior knowledge and experience, and they foster an analytical view of teaching situations which enables teachers to build practical knowledge through the integration of theory and practice (Kersting, et al, 2012).

1.1.1. Video annotation tool for reflective practice. Cited in Rich & Hanafin (2009), in the late 1980s and 1990s, video-based research was focused in using video to examine teacher thinking, decision making, and reflection. Since then, video has become very common in educational practice. In late 2000s, online websites, such as InTime, TeachScape, LessonLab, CaseNext, and TeachFirst present a variety of video cases in learning contexts for reflection for teachers (Pea & Hoffert, 2007). Although considered to have many advantages, however, functionally, linear video has limitations in terms of "systematically observation", in which observers will find difficulties to mark certain important segments on the video, analyze and present structured reflection directly on the video (Rich & Hannafin, 2009). With the advance of technology, annotation tools designed over the previous 10-15 years enable various artifacts to be annotated, such as web pages, digital text, images, audio, video, or a combination of media forms (Colasante, 2012). In educational technology, during recent years, video annotation has evolved and resulted in more advantages and usefulness for examining and improving reflective practices.

1.1.2. The effect of video viewing on teachers’ professional vision. With the widespread use of video annotation as a reflection tool, the focus of research today is not merely on the aspects of video usage, but also to examine how teachers employ their cognitive ability to notice and interpret the classroom events within the video, which called teachers' professional vision (Sherin, 2005).

The term professional vision was first introduced by Goodwin (1994) which refers to a way of describing the ability of professional group members to interpret the main phenomenon at the center of their attention. According to Goodwin, professional vision involves "how to see and understand events that are responsible for the particular interests of a particular social group" (p. 606). Thus, the professional vision of teachers involves the ability to notice and interpret the significant features of classroom interactions. The conceptualization of the professional vision refers to the nature of teachers’ activity during they view the video reflection of classroom activities. Watching a video, as said by Sherin (2007) "involves perceptual processes, it is not passive, and along with all perceptual processes; professional vision is characterized by bottom up as well as top-down processes." Furthermore, Sherin (2007) revealed the majority opinions in the literature regarding the nature of teachers’ activities while they are watching classroom videos. The main feature in this condition is teachers’ involvement in the perceptual processes with two main components, which are: selective attention and knowledge-based reasoning.
(1) **Selective attention:** concerns how the teacher decides where to pay attention at a given moment. Classroom is a complex environment, of which many things happening at once. When a teacher gives his or her attention to the classroom visualized on the video, they must choose from among this complexity where to focus his or her attention. In the video of classroom practice, a teacher probably will focus their attention on some aspects of learning, for example to the object of the teacher or students, and the learning process they are interacting in.

(2) **Knowledge-based reasoning:** refers to the ways in which a teacher reasons about what is noticed based on his or her knowledge and understanding. For example, a teacher might reason about a particular event based on his or her knowledge of the subject matter, knowledge of the curriculum, or knowledge of students’ prior comments. Lee (2005) in Cheng & Chau (2009); Kleinknecht & Schneider (2013) mentioned about 3 (three) levels of reflective thought which can be employed for analyzing teachers’ knowledge-based reasoning as promoted by Sherin (2007), which are: (a) **Describe**, which describes what one experienced, and interprets the situation based on recalling the experiences without looking for alternative explanations (recall); (b) **Explain**, which looks for relationships between pieces of the experiences, interprets the situation with rationale and generalize the experiences (rationalization); and (c) **Evaluate**, which approaches the experiences with an intention to change or improve in the future, and analyses the experiences from various perspectives (reflectivity).

1.2. **Guided-discovery learning instruction as promising teaching framework**

In the traditional teaching concept, knowledge was mostly acquired through memorization and recitation techniques. This approach has led students to become passive and thus less able to apply their knowledge in solving their daily life problems (Shieh&Yu, 2016). However, the constructivist paradigm has brought very significant changes to the conceptual belief and practical process of learning and teaching, in which students are encouraged to actively construct (build) their knowledge through exploration and discovery activities (Mayer, 2004). Guided discovery is one of the constructivist-based approaches that emphasize the provision of student-centered learning activities while supported by adequate guidance (Eggen & Kauchak, 2012).

1.2.1. **The instructional features of guided-discovery.** Clark and Mayer (2008) revealed that as an instructional architecture, in guided discovery, students assigned an unsolved case or job task, along with teacher's guidance on how to process incoming information, based on a knowledge construction view of learning. Teaching approach supported in guided discovery instruction are to cultivate students' skill of exploration, discovery, problem-solving and critical thinking skills through creative learning activities. The above-mentioned definitions underlined the key features of guided-discovery approach (Lavine, 2012), which are: (1) Guided-discovery is an instructional approach, a teaching strategy, which provides particular way of teaching and particular way of students' learning experience to achieve the expected learning outcomes; (2) This approach should be grounded on the perspective that students achieved their competence through exploration, discovery, problem-solving task-based as well as cultivate their critical-thinking skill through more student and task-based activities; (3) The role of teacher is to provide appropriate learning environment, along with structural guidance during the constructive learning activities; and (4) The assigned tasks for students refer to relevant problem-solving attempts and applicable skills in the real world.
In developing discovery instructional strategies, Moore (2015) emphasized that teachers’ ability to plan, organize and perform the method of scientific investigation greatly determines the level of successful discovery learning. The teacher's role is to provide situations that allow students to analyze problems and then guide and help students to find a connection between their initial knowledge and new-acquired knowledge.

In detail, Westwood (2008) described that instructional steps with guided discovery generally take these following format: (1) Identify the topic or problem-issued. The identification and clarification stage of the problem is a crucial part in order to future finding solutions. The role of the teacher is to provide a clear picture of the problem and guide students to understand them; (2) Teachers and students work in brainstorming discussion for finding the ways of investigating the topic. The teacher takes a role in providing accessible resources for students to find the best way of solving the problem; (3) Students work in small groups or individually to obtain and interpret data. At this stage, the teacher’s role is to help students by pointing out some key points, showing relationships, and provide guidance questions for conclusions to draw; (4) Tentative conclusions and findings are drawn, then presented for sharing-group discussion, and modified if necessary. The teacher acts as a mediator and builds reciprocal communication among students to get the right conclusions; and (5) The teacher provides clarification to avoid misconceptions, summarizes the findings and assists in making conclusions. At this stage, students should have a clear understanding of the topic as a result of learning outcomes.

1.2.2. The needs for teachers’ action regarding implementation of constructivist-based instruction. According to the regulation of the minister of education and culture of the Republic of Indonesia Number 22 of 2016 concerning primary and secondary education recommends “…To strengthen the scientific approach, thematic (integrated among subjects), thematic (in a subject), it is necessary to apply disclosure-based learning (discovery/inquiry learning) ...”. Therefore, it is compulsory for a professional teacher, especially vocational teachers, to be skilled with a competence of using various way of serving the learning content and achievement of the purposes and objectives including the guided-discovery-based instruction. This will strengthen teachers’ position as professionals who have role as a learning agent to improve the quality of national education (Act No. 14, 2005).

Meanwhile, it is not enough for teachers to solely rely on teaching skills to become a professional. Reflection is one of the most important things to do in order to enhance the role and responsibility of professional teachers as said by Bowman (1989) that self-reflection is a major element of professionalism. The definition of reflection (Tripp&Rich, 2011) as “... a self-critical, investigative process wherein teachers consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices...” provides a new perspective that reflecting on the teachers’ professional practices, especially learning and teaching is an important factor for the improvement of classroom innovation and revolution (Loughran, 2005).

2. Material and Methods

This research was conducted by using qualitative approach based on the consideration that it was more well suited to use for obtaining more in-depth analysis and detailed data about a particular event. In its practice, qualitative research does not provide treatment to the subject of research. As revealed by Schreiber & Asner-Self (2011: 9) that "Qualitative researches tends to
study things in their natural setting, attempting to make sense of or interpret phenomena in terms of the meaning of people bring to them."

Subsequently, this qualitative research study has been classified as descriptive case study and organized around multiple case involved six unit of analysis (Yin, 2014). The multiple case in this study aimed to explore teachers’ nature in engaging reflective practice of guided discovery implementation by using online video-based reflection system. The logic underlying the use of multiple case studies, as explained by Yin (2009) is the replication approach embedded in which each case must be carefully selected so that it either “…a) predicts similar results (a literal replication) or b) predicts contrasting results but for anticiaptable reasons (a theoretical replication).

2.1. Participants
Six Teachers from several Vocational High School settings paired into three groups of subject teaching were chosen by using purposive sampling technique in order to identify common patterns across a variety of teaching context. They are all described in this following table:

| No. | Name               | Code | Level of Education       | Sex  | Age | Teaching Subject | Teaching Experience (years) | Personal Status | Institution |
|-----|--------------------|------|--------------------------|------|-----|------------------|-----------------------------|-----------------|-------------|
| 1.  | Mathematics Teacher 1 | MT 1 | Bachelor’s Degree        | Female | 45  | Math             | 17                          | Civil Servant   | SMK A       |
| 2.  | Mathematics Teacher 2 | MT 2 | Master’s Degree          | Female | 32  | Math             | 12                          | Civil Servant   | SMK B       |
| 3.  | English Teacher 1   | ET 1 | Bachelor’s Degree        | Female | 37  | English          | 11                          | Civil Servant   | SMK A       |
| 4.  | English Teacher 2   | ET 2 | Master’s Degree          | Female | 36  | English          | 13                          | Civil Servant   | SMK C       |
| 5.  | Vocational Teacher 1 | VT 1 | Bachelor’s Degree        | Male  | 35  | Vocational       | 10                          | Civil Servant   | SMK A       |
| 6.  | Vocational Teacher 2 | VT 2 | Bachelor’s Degree        | Female | 37  | Vocational       | 12                          | Civil Servant   | SMK B       |

The researcher selected the participants with some considerations that they are all in-service teachers in vocational public high schools, they have been served as public servant teacher, have more than five years teaching experience, and willing to join the research to improve their professional development.

2.2. Procedures
This research involved the online video-based annotation tool supported reflective practice and a series of procedures which took placed over three months.

2.2.1. The iCRT online video-based annotation tool utilized for reflection activities. The iCRT System stands for i-Critical Reflection on Teaching; is an online video-based system supporting reflective practice developed collaboratively by Dr. Wu’s Research Team in National Central University of Taiwan. This web-based system provides self-reflection and collaborative
reflection through peer-feedback and provides ten categories of video annotation tool features based on Rich & Tripp (2011).

**Annotation functions.** The iCRT System provides two different kinds of written annotation functions, which are: (1) **Marking**, which means giving the written comments on the timeline without any categorization or framework for consideration; and (2) **Tagging**, refers to giving the written comments on the timeline based on some tags which made by the administrator to categorized and differentiate the comments.

![Collaborative function](image)

**Figure 1.** The annotation functions

**Collaborative function.** The iCRT System allows users to have asynchronous collaborative in feature by considering the connection and security issue.
Guiding framework for reflection functions. iCRT System provides user guide in feature.

![Guiding framework for reflection function](image)

**Figure 3.** Guiding framework for reflection function

**Physical access (online or offline) function.** The most advantage feature in iCRT System is the provision of online physical access with the ability to store the video database in social media by embedding the video code from Youtube. So the system will remain compact, light, and accessible.

**User restriction function.** One other advantage of this iCRT system is that the user limitation feature has made unrelated to the video content of the reflection. So that the reflection data already made will not be easily modified by other users. While the video settings depend on Youtube’s privacy policy which currently performs highly prioritized the interests of users.

**Video format function.** Due to embedding video into youtube, yet the video formats which are possible to be integrated within the system become very varied, among others: MOV, MPEG4, .MP4, .AVI, .WMV, MPEGPS, .FLV, 3GPP, WebM, DNxHR, ProRes, CineForm, HEVC (h265).
Administrator controlling function. iCRT System is a community-supported reflection support tool. To maintain interconnection among members, the administrator role is required. The administrator takes a role as a data manager. A user can upload and perform reflection in which administrator has already set up for the user.

Complexity of use. iCRT has a simple display, easy to use, and compatible, both in terms of storage and data access. However, it has limitations in terms of not supporting media annotation other than video such as pictures, sounds or documents.

The form of presented video analysis. iCRT System only able to generalize the written comments. This is the system need to be enhance in the future.

The cost of video annotation tool. Due to simplicity, iCRT System will be affordable for users.

2.2.2. Reflection Procedures supported by iCRT System. The procedure for the researcher and participants of using the online video-based annotation tool during the study will be illustrated in the following figure:

![Figure 5. Procedure for administrator and participant in using the iCRT](image-url)
(1) Set-up activity by administrator represented by the researcher; (2) Teachers record the teaching practice, and upload into youtube channel. To support this activities, the administrator created a youtube channel called iCRT System to collect all the video from community member; (3) Teachers analyze the teaching by performing self-reflection as well as collaborative reflection in peer-feedback; and (4) Teachers improve their teaching practice by considering the reflection results. This procedure is cycled into three stages of reflection activities in order to improve teaching performance.

2.3. Data Collection
2.3.1. Observations. Observations were conducted in order to investigate how a certain task of self-reflections were performed by the teachers. Researcher would take a role as administrator of the online video-based reflection system and observed all the teacher’s activity of reflections.

2.3.2. Interviews. The researcher conducted semi-structured interviews with participants two times, which are after they had first stage of reflective practice and after they finish all 3 (three) stages of reflection activities. Interviews were conducted to explore further information about teachers’ perceptions toward guided discovery approach implementation, how teachers experience in practicing reflection activities and to know their impression of using the online reflection systems.

2.3.3. Documentation. Documentation techniques in this study were used to review the supporting documents which related the research, for example, the research proposal, the photographs of learning activities and research activities as well as letters and participants’ biography.

2.3. Credibility of the research. The evaluation of qualitative research is different from quantitative research. To examine the validity and reliability of this research, the researcher used triangulation. According to Lodico, et al. (2006), triangulation is a process used by qualitative researchers for data analysis when different data sources are compared with one another. In this research, data from the first to the third stage of reflection were compared to get the score difference in order to examine the change in the teachers’ teaching practice during the program. The researcher also employed the inter-coder reliability process to make sure the reliability of the results. The amount of reflection and data from the interview were then triangulated. The emerging themes from the data triangulation were then examined using the existing literature to derive a conclusion.

3. Results and Discussions
3.1. Teachers’ nature in performing self-reflection regarding guided-discovery approach
This section explains teachers’ nature in engaging self-reflection activity including the following aspects of their perceptual process as they sought their teaching practice video provided by the iCRT system. The professional vision framework (Goodwin, 1994) has been used to analyze teachers’ ability to notice and interpret specific features of their teaching practice video. There were two sub-processes of professional vision (Sherin, 2007) which have been integrated during the reflection process consisting of (a) selective attention and (b) knowledge-based reasoning.
3.1.1. Teachers more focus on their actions in providing guided-discovery instruction. While viewing on one’s own teaching practice video, there would be the object as a focus of attention or considered as the most interesting aspect to comment on. The first pattern to discover from the comments distributed to each category in self-reflections among six participants in three stages is that in general, teachers selectively placed the object of attention on teacher as their focus more than to students. In stage 1, teachers initiated 85% of important events in the video noticed to teachers’ activity. It means that what teachers have done, what they have thought or say became the most consideration to be commented. It was also applied to stage 2 (89%) and stage 3 (82%).

Table 2. The difference of average numbers of comments given to the selective attentioned object.

| Focus of Attention | Stage 1 n=84 | | Stage 2 n=87 | | Stage 3 n=83 |
|--------------------|-------------|-------------|-------------|-------------|-------------|
|                    | Mean, (SD)  | %           | Mean, (SD)  | %           | Mean, (SD)  | %           |
| On teacher         | 11.83, (5.97)| 85%         | 12.83, (4.73)| 89%         | 11.33, (5.09)| 82%         |
| On students        | 1.67, (2.07)| 12%         | 1.67, (1.21)| 11%         | 2.17, (1.83)| 16%         |
| Other objects      | 0.50, (0.84)| 4%          | 0.00, (0.41)| 0%          | 0.33, (0.52)| 2%          |

ET 2 at the interview session stated that "...Of course, the main thing I most noticed during my reflection was myself, how I tried to translate the guided discovery principles into my students’ learning activities. So I would really notice everything I did when I was watching my video.” As VT 1 also stated that "Because I was reflecting on my performance, so I put my focus more on what I did to implement guided discovery in my classroom.”

![Figure 6. Teacher's tendency to focus on a specific object in the video](image)

However, it can be observed in Figure 6. that the average number of attention focuses on teachers slightly decrease, from stage 1 (11.83, 85%) to stage 3 (11.33, 82%). In contrast, teachers apparently more students focused in noticing their activities as the average number of reflection comments slightly increased from stage 1 (1.67,12%) to stage 3 (2.17, 16%).
Moreover, the student-focused comments were not evenly distributed, in fact on stage 1, only VT 1 and VT 2 teachers were giving some of their comments focused on students. But on stage 3, all teachers except ET 2 gave some of their comments focused on students.

3.1.2. In provision of guided-discovery instruction, teachers put the attention more on brainstorming activity. Janssen (2014) stated that "The prominent thing that distinguishes guided discovery instruction with pure discovery is the teacher intervention in providing guidance." It indicates that teachers’ actions to provide materials or make suggestions about problem solutions and to provide resources where information related to the problem area can be obtained are the most important aspect in guided-discovery (Moore, 2015). Related to the guided-discovery learning process, the interaction between focus of attention and the learning process shows interesting trends. In stage 1, the comments noticed teachers’ activity indicate that the most noticed process of presenting guided-discovery environment for students was the brainstorming activity (3.17, 23%), in which a teacher plays a role in providing all possible resources for students to understand the topics or to find the best solution of the discussed issues. And its average number shows a significant increase in stage 2 (4.17, 29%) to stage 3 (5.17, 46%). It reveals that teachers prefer to reflect more on their effort of providing guided discovery instruction, especially facilitating students during the brainstorming process.

Table 3. The interaction between selective attention dimensions: The average number of teachers’ noticed to the focused object and the guided-discovery learning events.
MT 1 also said the same thing at the time of the interview. According to her statement,

"My biggest challenge in practicing guided discovery is when I have to strictly organize learning materials, design activities which can motivate my students to actively exploring the topic is through problems, while in teaching mathematic lesson I am used to giving regular activities such as explaining topics, practice in exercise and evaluation.

In teaching Math, MT 2 also have the similar opinion about the way she provided guidance in brainstorming activity in math instruction. She said that,

"...What I was most concerning about in guided-discovery is when I directed my students to understand the concepts which had been the learning topic. I have to really prepare all the materials first, give examples and not examples, through pictures, real-life case examples, and usually I'm rarely do that, especially in math, because it's quite time consuming. But with this guided discovery, inevitably, I had to make changes and some adjustments in my teaching."

Westwood (2008) reinforces that in guided-discovery, the role of teachers is essential in preparing the structure of learning material. The teacher must ensure that students, from the beginning, have understood the learning purpose. S/he should also provide initial input or preliminary explanations to help students efficiently start the tasks, and can direct students to choose the right procedures for completing experience-based tasks or for solving problems. During the activity, the teacher can make suggestions, ask questions, or provide instructions. This form of 'scaffolding' will keep students focused on the learning objectives and will not be confused.

3.1.3. The teachers’ changes can be found in the interaction between selective attention and knowledge-based reasoning. Hereinafter, teachers’ comments were also have been analyzed to see how the teachers reasoned to the particular noticed event based on his/her knowledge and belief. The content analysis shows that comparatively, at stage 1, teachers placed their most attention to the important things which need to be evaluated, more than to describe or to explain. The average comments of reflection reasoned to evaluate was quite high (5.50, 40%) at this stage compared to describing (3.17, 26%) or explaining (5.00, 37%). This indicates that reflection activities in stage 1 found more aspects of teaching which need to be changed or improved. Yet in line with the improvement of teaching process, at stage 3, the average number of comments for the evaluation aspect significantly reduced (0.84, 4%), while most comments were on the level of describing (7.00, 54%) and explaining (5.17, 42%) the events or learning situations based on teachers’ professional belief. The numeric pattern of knowledge-based reasoning will be explained in the following table 10.
Table 4. The teachers’ knowledge based reasoning has been recognized

| Knowledge-Based Reasoning | Stage 1 Mean (SD) | Stage 2 Mean (SD) | Stage 3 Mean (SD) |
|---------------------------|------------------|------------------|------------------|
| Describe                  | 3.17 (1.33)      | 5.33 (3.72)      | 7.00 (6.87)      |
| Evaluate                  | 5.50 (5.39)      | 1.33 (1.51)      | 0.50 (0.84)      |
| Explain                   | 5.00 (2.45)      | 6.00 (3.41)      | 5.17 (2.71)      |

| Focus of Attention | Category | Examples of Comments                                                 |
|-------------------|----------|---------------------------------------------------------------------|
| On teacher        | MT 1 on Self Reflection 1 Coded as evaluate category | - I should explain the meaning of the order first, then the students can simulate the matrix in the frame as I assigned. |
| On teacher        | MT 2 on Self Reflection 1 Coded as evaluate category | - I used “examples and non-examples” so students would understand the characteristics of the Pythagoras theorem. However, if I use pictures/video, my students will be probably more understand. |

When the intersection data between selective attention and knowledge-based reasoning were examined only on two prominent guided discovery learning events, which are brainstorming process focused on teacher and working on data focused on students, an interesting proposition will be found.

Table 5. The data shows reasoning tendency noticed on teacher, particularly in the brainstorming process of guided-discovery

| Brainstorming Process | Stage 1 n=19 Mean (SD) | Stage 2 n=25 Mean (SD) | Stage 3 n=31 Mean (SD) |
|-----------------------|-------------------------|-------------------------|-------------------------|
| Describe              | 0.83 (0.98) 26%         | 2.00 (1.67) 48%         | 2.00 (2.10) 39%         |
| Evaluate              | 1.50 (1.87) 47%         | 0.33 (0.82) 8%          | 0.17 (0.41) 3%          |
| Explain               | 0.83 (0.75) 26%         | 1.83 (0.98) 44%         | 3.00 (2.61) 58%         |

There were 19 comments at stage 1 noticed on teachers at brainstorming process, positively increased to become 25 comments at stage 2, and later 31 comments at stage 3. Initially, teachers tended to reason on evaluate level (1.50, 47%) express their opinion about specific instructional aspects in the way of they provide guidance in brainstorming activity intended to be changed or improved. Next, the number decreased in stage 3 (1 of 60 units, 2%). It is evidenced by some examples of teachers comments as follows:
Figure 7. The examples of teachers’ comments noticed to teachers’ brainstorming process

From the abovementioned evaluate comments, it can be seen that teachers, generally focused on the shortage of facilitating the brainstorming process, such as: lack of supportive learning designs, as well as supporting tools (utilize of presentation media, pictures or video). The figure 7. illustrate the variation of changes.

Table 7. The data shows reasoning tendency noticed on students, particularly in the working on data process of guided-discovery

| Brainstorming Process | Stage 1  
|-----------------------|--------|
|                       | Mean (SD) | % |
| Describe              | 0.00 (0.00) | 0% |
| Evaluate              | 0.60 (0.84) | 60% |
| Explain               | 0.40 (0.52) | 40% |

| Brainstorming Process | Stage 2  
|-----------------------|--------|
|                       | Mean (SD) | % |
| Describe              | 0.25 (0.41) | 25% |
| Evaluate              | 0.25 (0.41) | 25% |
| Explain               | 0.50 (0.52) | 50% |

| Brainstorming Process | Stage 3  
|-----------------------|--------|
|                       | Mean (SD) | % |
| Describe              | 0.50 (0.41) | 50% |
| Evaluate              | 0.00 (0.00) | 0% |
| Explain               | 0.50 (0.41) | 50% |

An overall comments focused on students at stage 1= 10, stage 2= 10, and stage 3= 13 focused on students’ working on data activity.
Due to the small number of comments to conclude this fact, we need to look further on some examples focused on students’ activity in the *working on data* process.

**Table 8.** The examples of teachers’ comments noticed to students’ working on data

| Focus of Attention | Category | Examples of Comments |
|--------------------|----------|----------------------|
| On students        | ET 1 on Self Reflection 2 Coded as describe category | Students, guided by the teacher, composed sentences of Simple Present Tense for Verbal Sentence after having the explanation given by the teacher. |
| On students        | VT 2 on Self Reflection 1 Coded as evaluate category | Despite the insufficient number of camera equipment, my students remain actively exploring techniques by collaborating with friends. |
| On students        | MT 2 on Self Reflection 3 Coded as explain category | Students appear to be very active in group assignment because I have actively involved in each group to control their performance and provide guidance. |

From these examples of comments, it can be seen that at the explaining level, teachers recounted the events in their video practice including explanations of the causal aspects or reasons related to the pedagogical aspects or they beliefs about guided-discovery. All comments referred to some aspects, including teacher assignment methods (*e.g.* worksheets, practical activities), interaction forms in the process of working on data (*e.g.* group assignments), as well as teachers’ behave that should be performed during the process (*teacher activeness, assessment, and guidance provision*).

### 4. Conclusion

To comprehend teachers' nature in performing their reflective practice, professional vision framework is applied to see how the teachers intended in giving comments and how teachers analyze their performance using video-based reflection system. These activities involving selective attention aspect, which means teachers' tendency to decide what object served as the focus of attention and what event was happening on the particular scene. And knowledge-based reasoning has interacted with selective attention to represent the underlying knowledge of
reason of teachers giving reflection comments. The major findings of this study were outlined as follows.

It can be generated from the iCRT system database that teachers tend to put most of their attention to their own action as focus of attention, more than to students. The interview results confirmed that it is because the reflection practice were focused on viewing their performance through video, so their main focus would be on their action in providing appropriate guided-discovery instruction for students. Subsequently, Guided-discovery learning events which generally received the most attention was the brainstorming process, based on conformational results through interviews, they suggested that at this stage, the teacher's role is crucial in providing "guidance" in which became the core of guided discovery.

The reflective practice on teaching performance is important and should be applied by in-service teachers for continuity and professional improvement, but this practice still reluctant for most of in-service teachers. With the iCRT system to support teachers for more easily analyze and reflect on their teaching performance, teachers in the future are expected to explore their pedagogical and professional skill of applying reflective practice towards various other innovative teaching methods and strategies. Furthermore, the implementation of reflective practice supported by this iCRT system can be further investigated collaboratively at the level of teacher group work for exploring the benefits of the system.

5. References

[1]. C. J. Shieh & L. Yu. (2016). Discovery Instruction towards students’ learning achievement and learning retention. Eurasia Journal of Mathematics, Science & Technology Education, 2016, 12(4), 833-842.
[2]. Cheng, G. & Chau, J. (2009). Digital video for fostering self-reflection in an ePortfolio environment. Learning, Media and Technology, Vol. 34 (4), 337-350.
[3]. Clark, R. C. & Mayer, R. E., (2008). e-Learning and the science of instruction, 2nd Ed. San Francisco, CA: Pfeiffer.
[4]. Colasante, Meg. (2011). Using video annotation to reflect on and evaluate physical education pre-service teaching practice. Australasian Journal of Educational Technology, Vol. 27 (1), 66-88.
[5]. Eggen, P., & Kauchak, D. (2012). Learning and teaching: research-based methods (6th ed.). Boston: Pearson Education, Inc., 306-335.
[6]. Gaudein, C. & Chaliès, S. (2015). Video viewing in teacher education and professional development: A literature review. Journal of Educational Research Review, Vol 16, 41-67.
[7]. Goodwin, C. (1994). Professional Vision. American Anthropologist, Vol. 96 (3), 606-633.
[8]. Grossman, P. L. (2005). Research on pedagogical approaches in teacher education. In M. Cochran-Smith & K. Zeichner (Eds.), Studying teacher education: The report of the AERA Panel on Research and Teacher Education teacher education (pp. 425-476). Washington, DC: American Educational Research Association.
[9]. Hawkins, Susan & Rogers, Meredith Park. (2016), Tools for Reflection: Video-Based Reflection Within a Preservice Community of Practice. Journal of Science Teacher Education, Vo. 27, 415-437.
[10]. Jay, J. K. & Johnson, K. L. (2002). Capturing complexity: a typology of reflective practice for teacher education. *Journal of Teaching and Teacher Education*, Vol 18, 73-77.

[11]. Jones, Mellita. (2014). Reflective practice in the online space. In Jones, M. & Ryan, J. (Eds.), *Successful teacher education: Partnership, reflective practice and the place of technology*. Rotterdam, Netherlands: Sense Publishers, 153-173.

[12]. Kersting, N. B., Givvin, K. B., Thompson, B. J., Santagata, R., & Stigler, J. W. (2012). Measuring usable knowledge: teachers’ analyses of mathematics classroom videos predict teaching quality and student learning. *American Education Research Journal*, 49(3), 568-589.

[13]. Kleinknecht, M., & Schneider, J. (2013). What do teachers think and feel when analyzing videos of themselves and other teachers teaching? *Teaching and Teacher Education*, Vol. 33(1), 13-23.

[14]. Lavine, Robert A., (2012). Guided Discovery Learning. In Norbert M. Seel (Ed.), *Encyclopedia of the sciences of learning*. Springer US, 1402-1403.

[15]. Lee, H. J. (2005). Understanding and assessing pre-service teachers’ reflective thinking. *Teaching and Teacher Education*. Vol. 21, 699-715.

[16]. Lodico, M. G. *et al.* (2006). *Methods in educational research*. San Francisco: Jossey-Bass, 265-267.

[17]. Loughran, John. (2005). *Developing reflective practice: Learning about teaching and learning through modelling*. London: The Falmer Press, 4

[18]. Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. *The American Psychologist*, 59, 14–19.

[19]. Moore, Kenneth D. (2015). *Effective instructional strategies: from theory to practice (4th ed.).* California: Sage Publications, 294-298

[20]. Pea, Roy & Hoffert & Erick. (2007). Video workflow in the learning sciences: Prospects of emerging technologies for augmenting work practices. In Goldman, *et al.*, *Video Research in the Learning Science*. Mahwah, New Jersey: Routledge, 427-460.

[21]. Rich, P. J., & Hannafin, M. (2009). Video annotation tools: Technologies to scaffold, structure, and transform teacher reflection. *Journal of Teacher Education*, 60(1), 52-67.

[22]. Schreiber, J. B., & Asner-Self, K. (2010). *Educational research*. Wiley Global Education, 9.

[23]. Seidel, *et al.* (2011). Teacher learning from analysis of videotaped classroom situations: Does it make a difference whether teachers observe their own teaching or that of others? *Journal of Teaching and Teacher Education*, Vol. 27, 259-267.

[24]. Sherin, M. G., & Van Es, E. A. (2005). Using video to support teachers’ ability to notice classroom interactions. *Journal of Technology and Teacher Education*, 13(3), 475-491.

[25]. Sherin, Mirriam G. (2007). The development of teachers’ professional vision in video clubs. In Goldman, *et al.*, *Video Research in the Learning Science*. Mahwah, New Jersey: Routledge, 383-395.

[26]. Suratno, S. & Iskandar, S. (2010). Teacher reflection in Indonesia: Lessons learnt from a lesson study program. *US-China Education Review*, Vol 7 (12), 39-48

[27]. Tripp, R. T., & Rich, J. R. 2011. Using video to analyze one's own teaching. *British Journal of Educational Technology*, 43(4), 678-704.

[28]. Tripp, R. T., & Rich, J. R. 2012. The influence of video analysis on the process of teacher change. *Journal of Teaching and Teacher Education*, 28, 728-739.
[29]. Valli, L. (1997). Listening to other voices: A description of teacher reflection in the United States. *Peabody Journal of Education*, 72(1), 67–88.

[30]. van Es, E. A. & Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers’ interpretations of classroom interactions. *Journal of Technology and Teacher Education*, Vol. 10 (4), 571-596.

[31]. Westwood, Peter. (2008). *What teachers need to know about teaching methods*. Victoria, Australia: ACER Press, 28-30

[32]. Yin, Robert K. (2009). *Case study research: Design and methods (4th Ed)*. California, US: Sage Inc.