



Computer-based examinations: unearthing exam invigilators' perspectives, tacit work-related knowledge, and skills via reflection-on-experience

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ABSTRACT

The purpose of this small qualitative study was two-fold: one, to show how reflection-on-experience enacted through interviews can unearth the tacit work-related knowledge and skills exam invigilators developed on the job. Two, to continue redressing the lack of attention given to invigilators in the research literature. Interviews were the data collection method used and responses analysed to reach interpretation and answer the research questions.

Interview results revealed participants viewed invigilating computer-based examinations as either 'easy' or 'demanding'. They displayed knowing: the facets or procedures of exam invigilation (timekeeping, giving instructions, rest, or toilet breaks), the characteristics of the students (special educational needs—SEN), and computer and operational knowledge—such as knowing about a USB stick and deleting a document, and who to call when there is a problem with a computer. Participants also displayed procedural skills (discretely directing students to the toilet and computer troubleshooting) and intangible skills (mental flexibility, care, and creativity).

This study shows, through a critical discussion of the literature, coupled with the findings that invigilators learn on the job, i.e., they developed work-related knowledge and skills. Knowledge and skills are often implicit or tacit and may remain that way if not given an opportunity, via reflection, to be made explicit.

Keywords: Examination Invigilator, Exam Invigilation, Work-related knowledge, Computer-based exams, tacit knowledge, reflection, reflective practice, skills.

Introduction

In the past, the Higher Education (HE) and Further Education (FE) sectors seem to have considered online and computer-based learning and teaching second best to the superior, face-to-face learning and teaching. This way of thinking also influenced examinations for paper-based examinations were the preferred method of assessing and evaluating students' content knowledge. However, it is now a fact that the COVID 19 pandemic has had a disruptive effect on teaching and learning as conducted in HE and FE classrooms. This disruption was not gradual but immediate as institutions moved to online and computer-based learning and teaching. The effects of this rapid move to online and computer-based learning and teaching on students and teachers are yet to be researched fully and made clear.

This rapid move to online and computer-based learning and teaching necessitates the use of online and computer-based examinations overseen by invigilators (UK) or proctors (USA). Invigilators or proctors are people who implement examinations according to rules set by further and higher education institutions and examination boards.

Several literary sources examine teachers' learning and the increased use of online and computer-based pedagogy triggered by the COVID-19 pandemic. A search of the university database using the keywords: online learning, computer-based, teachers, teacher learning and the filter 2019 to 2021 returned 1,886 hits. However, none examined invigilators' learning concerning the use of online and computer-based examinations also triggered by the COVID-19 pandemic. A search of the university database using the

keywords: online learning, computer-based, invigilator, invigilation, proctor, learning and the filter 2019 to 2021 returned 0 hits. In light of this paucity of literature, a study was launched.

Aim, Research Questions and Rationale.

This small study uses 'reflection-on-experience' enacted through interviews to synthesize the perspectives of four further education exam invigilators on invigilating computer-based exams and unearth the tacit work-related knowledge and skills they developed on the job. The research questions were, what are exam invigilators' perspectives and experience of invigilating computer-based examinations and what knowledge and skills do they develop while doing this job? During the interview, the participants were asked and provided answers to an open-ended question: "Think about an experience of invigilating a computer-based exam; tell me about this experience."

This study is important for several reasons: one, there is a paucity of research that examines the perspectives and role of exam invigilators and their work-related knowledge and skills developed on the job (Minott, 2018 and 2020). Two, the study aids in filling this literary gap and gives invigilators a 'voice' in the research literature. Three, it displays some work-related knowledge and skills developed while invigilating computer-based exams. Finally, the move to online teaching caused by the pandemic has implications for exam invigilation policy and practice has discussed later in this paper.

This report commences with a review of the literature. It ends with a critical discussion and display of participants' perspectives and tacit work-related knowledge and skills developed via 'reflection-on-experience', enacted through interviews.

Literature Review

Computer-based examination, Invigilation and developing knowledge and skills

There is a growing body of work on issues and ideas linked to computer-related exam invigilation, for example, (James, 2016; Lilley, Meere, & Barker, 2016 and Shepherd, 2010). The onset of the pandemic and seeming wholesale move made by further and higher education institutions to online learning brought discussions about computer-based exams and invigilation back into focus.

Central to the discussion is the idea of replacing human invigilators with technology capable of taking students' fingerprints electronically to check their identity and using a 360-degree webcam and microphone. These technology tools pick up students trying to cheat by receiving help from others. Computers also lockdown so that the student cannot search the internet or their files for answers. Webcams and microphones record the students taking the exam and, invigilators then watch the footage whenever they choose to ascertain whether or not the exam ran according to set rules (Shepherd, 2010).

Progress in such an undertaking is, however, stymied by lingering ideas that students not under direct human supervision have the opportunity to engage in activities, such as collusion with others or reference inappropriate materials during the exams, which bring the academic integrity of the exam process into question (James, 2016). Additionally, the presence of a human invigilator has affective benefits. For example, students in the study carried out by Lilley, Meere, & Barker (2016) state that the presence of a human invigilator in the room gave them 'peace of mind' in the event of technical problems occurring during the computer-based exam.

What seems acceptable in the literature on computer-based exams—at least for now—is the use of human proctors or invigilators coupled with appropriate software and biometrics to reduce the temptation to cheat and ensure the correct identification of the students (Bedford, Gregg, & Clinton, 2011; Harmon, Lambrinos, & Buffolino, 2010; Watson & Sottile, 2010). An example of combining human invigilators and technology is 'remote live invigilation' (Lilley, Meere, & Barker, 2016). In remote live invigilation, the invigilator and students are in different countries. However, the invigilator is human.

The invigilation procedures for the 'remote live invigilation' are similar to those required in a face-to-face exam. For example, the invigilator must know the facets or processes of invigilation: checking students' identification cards, ensuring the removal of unauthorised materials from the exam area and room, reading the exam rules to the students, and inviting students to log into the exam application (Lilley, Meere, & Barker, 2016). The difference is, these activities are mediated by a webcam, microphone and special software downloaded to the students' computer. In addition, the invigilator must have some computer-related knowledge and skills.

Schools, colleges, universities, and exam boards train invigilators and, by so doing, aid the development of necessary knowledge and skills. Training usually lasts one or two hours and focuses on the tasks associated with invigilation. There is evidence that invigilators develop knowledge and skills away from these formal training exercises. This development occurs while they grapple with the activities of invigilation (Minott, 2020). The knowledge they develop links with the tasks of invigilation and, therefore, is work-related. While the work-related knowledge and skills developed enable invigilators to function in their role, they are tacit and may remain known only to the individual. Without the opportunity to reflect on their experience, this developed work-related knowledge and skills may remain implicit.

Reflection and tacit work-related knowledge

Over the past 30 years, the teaching profession has embraced the notion of the teacher as a reflective practitioner. Ghaye and Ghaye (1999) see reflection as thinking about what you do, and Farrell (2001) sees it as thinking critically about what you do, which involves recall, consideration, and evaluation of experiences. For this study, reflection is careful consideration or thought; it is a process of disciplined intellectual criticism combining research, knowledge of context, and balanced judgment (critical thinking) about previous, present, and future actions, events, or decisions (Minott, 2009).

Engaging in 'reflection-on-experience' enables an individual to create distance between themselves and their practice. It also involves analysing, discussing, evaluating, changing, and developing workplace practices, by adopting an analytical approach to their work. Sometimes an experience or unexpected incident trigger this process (Boyd & Fales, 1983).

It is safe to conclude that interviews triggered reflection by this study's participants. The process of reflection includes recall, considering, and evaluating an experience of invigilating a computer-based exam. This is so because—as will be shown later through the interview—they had to recall (give an account of an experience), consider, and evaluate the experience. Statements proving evaluation took place include: 'I thought it [the exam] was disorganised' and 'Outcome: more responsibility for the invigilator'.

Warren-lee (2017) states that tacit knowledge is a personal form of knowledge that plays a key role in the practice and professional development of teachers and is acquired by addressing real problems and engaging in day-to-day work activities. Tacit knowledge of professionals is seldom expressed but guides professional practice (van Braak, Groot, Veen, Welink, & Giroldi, 2018). Warren-Lee (2017), in her study, evaluated the tacit knowledge of experienced teachers via the use of interviews. Interviewees reflected on their teaching and explained their teaching actions.

Schulman and Schulman (2004), speaking specifically of teachers' tacit work-related knowledge, point out the role of reflection. The writers state that learning from experience via reflection improves teachers' ability to effect purposeful change and integrate the various aspects of teaching into practice. Linking this statement to exam invigilators means that reflecting on experience will bring out knowledge and skills developed on the job. The results of this study support this idea. Additionally, doing so improves invigilators' ability to effect change in the process of invigilation.

Jones and Moreland (2005) also used reflection as a strategy to enhance teachers' work-related knowledge. They, however, argue that teachers who understand the characteristics of the subject they teach develop more secure guidelines for thinking about what is of importance in the learning activities. This idea is also relevant to invigilators. This is so because a secure understanding of the procedures of exam invigilation can guide thinking about changes to improve the invigilation process.

Study Outline

Participants' selection, research questions and ethical consideration

Four further education invigilators participated in this small-scale study—one male and three females. They each had between 5-10 years' invigilation experience. They were all employed by a London-based further education college as casual workers, where they carried out the tasks of invigilation.

Opportunity sampling was used in the selection of the participants, who were 'information-rich'. Guba & Lincoln (1998) state that 'information-rich' participants can provide insight into the issue of importance to any study. Examining the findings in this paper and participants' responses show they provided relevant and unique perspectives on the research issue.

The broad research questions were, what are exam invigilators' perspectives and experience of invigilating computer-based examinations? What knowledge and skills do they develop while doing this job? To answer

these questions, the participants provided answers to an open-ended question: "Think about an experience of invigilating a computer-based exam; tell me about this experience."

Since there is no ethics or research department in the college, I employed the following ethical procedures. I asked participants if they were willing to participate in the study. They all agreed and requested that their names be excluded. This was agreed and, (as will be shown later) they were referred to as exam invigilators (EI.1- 4) and no names were mentioned in this paper.

Data Collection.

As indicated in the foregoing discussion 'reflection-on-experience' enacted through interviews was the data collection method. I chose to use interviews for there was the need to understanding the participants' experience and gather information (Joffe, 2001). The benefits of reflecting-on-experience are well documented. Reflecting-on-experience provides an opportunity to improve practice by employing and developing cognitive skills (Farrell, 2001). Hyrkas, Tarkka & Ilmonen (2001) point out, reflecting-on-experience can lead to creative and innovative approaches to classroom and school situations and problems.

For a week, and at a time during the day considered convenient by each, participants were individually asked the open-ended question: "Think about an experience of invigilating a computer-based exam; tell me about this experience?" I then wrote their responses. They were told the length of their response was up to them. Some, however, choose to be brief and, others, lengthier. To contribute to the validity of the findings, they read the transcript of their interview and asked to say if it faithfully represents their view (Elliot, 1991). Only minor changes were made.

Data Analysis.

I analysed the responses or answers to the research question using the NVivo software. Powell and Renner (2003) support the use of pre-set categories when examining data. They also state that pre-set categories provide direction for what to look for in the data. In light of this, responses were examined for participants' perspectives on invigilating computer-based examinations and examples of knowledge and skills they developed.

Specifically, I analysed responses to the research question using a content analysis process. To focus the analysis, I placed together files on the NVivo software according to participants answers to the open-ended question. By reading and re-reading the responses and using my judgement and experience to make sense of their comments, I extracted words and phrases from their responses that support the pre-set categories or themes, 'knowledge developed' and 'skills developed'. For example, participants viewed invigilating a computer-based examination as either 'easy' or 'demanding'. Under the category 'knowledge developed', the analysis revealed participants displayed knowing: the facets or procedures of exam invigilation (timekeeping, giving instructions, allowing rest, or toilet breaks), the characteristics of the students (special educational needs (SEN) and computer and operational knowledge, such as knowing about a USB stick and deleting a document, and who to call when there is a problem with a computer. Under the category of 'skills developed', the participants displayed procedural skills (discretely directing students to the toilet and computer troubleshooting) and intangible skills (mental flexibility, care, and creativity).

These results appear in the next section of this paper that discusses the findings. The main research questions reworked as statements guide the discussion.

Discussion of Findings

Exam invigilators' perspectives on invigilating computer-based examinations.

Participants of this study thought the invigilation of computer-based examinations was either easy or demanding. Exams that are organised and controlled by an external exam board demanded less from the invigilator. The exam invigilators explained:

It [computer-based exam invigilation] is easier; no need to shout to students sitting the exam "5 minutes!" before the end of the exam. The timer clock is on the computer and does the talking for you, including, when the exam is finished—the computer just locks the screen (EI.2).

"Easy: everything is on the computer, timer, instructions; it does require reminding the candidate to carefully read the on-screen instructions before commencing the actual exam" (EI.4).

Viewed as more demanding were exams organised and controlled by the local institution for students with Special Educational Needs (SEN). "...so, all in all, I would say is that more support is required for these students (SEN) than in an open classroom/hall where no computers are used. Outcome: More responsibility for the Invigilator" (E1.3).

The inclusion of students with SEN in examinations generally and computer-based exams specifically, adds a new dimension to the invigilation process. This dimension includes giving additional or extra time for such students to complete exams. This added dimension requires exam invigilators to be able to—in one exam room and one subject—bring the exam to a close at different points in time and ensure that students' leaving early exit without distracting those still working.

Knowledge developed on the job.

It is via the process of reflecting-on-experience that participants unearthed what they knew about invigilation, as well as what they knew about invigilating a computer-based exam. An examination of their responses showed they built work-related knowledge and skills. The use of 'reflection-on-experience' in this process must be emphasised (Boyd & Fales, 1983, Schulman and Schulman, 2004, Jones and Moreland, 2005).

The analysis of their account revealed they developed several knowledge areas while on the job. Featured prominently in responses is a knowledge of the facets or procedures of invigilation. All participants displayed knowledge in this area.

For example, E1.1—in responding to the research question—was able to highlight facets such as 'timekeeping', giving instructions, taking students to the toilet. These occur when describing the ease of invigilating computer-based exams. E1.2 was also able to highlight facets in his response to the research question.

There is however the need to still do the regular exam stuff like attendance record keeping, reporting problems, checking students' ID, reminding them to turn off their cell/mobile phone and putting them away. Ensuring that additional material needed is provided such as a dictionary or calculator (E1.2).

Writings on exam invigilation highlight the importance of the facets identified by E1.1 and E1.2 to invigilation. For example, invigilation documents of Kings College London (2018) and the Ridgeway School & Sixth Form College (2016) reveal that the procedures highlighted by this study's participants are official duties of invigilators that they should know and perform.

The thought expressed by E1.2 is telling when, in response to the request to check the transcript of the interview said, he did not realise how much he knew, until he was reading the transcript. This thought highlights the importance of the opportunity to reflect-on-experience enacted via interview or through dialogue with others to bring to the fore tacit knowledge. Schulman and Schulman (2004) support this idea when the writers state that teachers must develop the capacity to learn from experiences. Doing so improves their ability to effect purposeful change and, reflection on experience is a tool to enable this to occur.

The analysis of the response of E1.3 highlighted her knowledge of the students and their characteristics as students with special educational needs (SEN). She also outlined an additional facet of the invigilation process required when invigilating an exam organised and controlled by a local institution for students with Special Educational Needs (SEN).

I have invigilated students taking exams in a computer room for those with a disability like dyslexia. For these students, extra responsibilities include ensuring correct login details are used and they do not use their personal login for the computer, the right lighting, and the air conditioning being 'ok'. Making allowances for their psychological frame of mind depending on their disability, as they can be extra anxious. Some students may need to sit near a window or door for their mental health (E1.3).

Also developed were computer and operational knowledge. For example, knowing when a computer has frozen or timed out, or a cable is loose, how to delete a document, and how and where to insert a USB stick. E1.3 elaborates:

At least a basic understanding of technology is needed to invigilate a computer-based exam. This is especially so in an exam organised by the school. Importantly, you need to know if and when an internet cable is disconnected and to remind students—before the exam starts—to save their work intermittently throughout the exam; but critically at the end, for the work to be saved onto a USB stick. Equally important is to delete work once saved so it cannot be seen by other students taking exams using the same computer afterwards (E1.3).

The thoughts of EI.3 seem to support the idea expressed in the literature review. The idea in the literature review states that, in addition to knowledge of the facets or procedures of invigilation, invigilators must also have computer-related knowledge (Lilley, Meere, & Barker, 2016). This idea is addressed later in this paper under the heading, implications for exam invigilation policy and practice. The idea is also important in light of the covid-19 pandemic induced 'move' to online learning experience by further and higher education institutions.

Operational knowledge was developed. This knowledge includes knowing who to call when there is a problem with a computer. EI.4 tells how important this knowledge is, particularly in a computer-based exam.

I remember I had a candidate where the system timed out and I had to get 'exams'[a member of the examination department] to provide me with the login details to get the candidate restarted, but no additional time was given to the candidate. Understanding that there was someone to call and where and when and how to contact the person is very, very, important (EI.4).

Skills developed on the job.

Under the category of 'skills developed', the participants displayed procedural and intangible skills. In the area of procedural skills developed, E1.1 said that one role of the exam invigilator is to discretely direct students to rest break (toilet) without disrupting the other students working. This is a skill she had developed in her role as an invigilator. The idea of the skills of computer troubleshooting was inferred from the response of EI.3. Should a problem with the computer occur, she was aware of the need to check the internet cable first before calling the exam department for help.

Intangible skills developed were mental flexibility, creativity, and care. Mental flexibility is seen when EI.4 concluded that she thought the exam she spoke of could have been a bit more organised concerning information given to the invigilators from the exam department, for example, exam start and end time, when students entered and when they were allowed to leave. Despite these issues, she carried out her role and was able to put these 'to the back of her mind'.

Being given a seating plan developed for a large hall to use in a small square-room computer lab, EI.2 had to be creative. He said,

There is still the need for the invigilator to be creative and reflective, especially when using documents such as a seating plan designed for straight row seating in a face-to-face exam situated in a computer lab with computers and students disbursed in a variety of positions and computer stations, not in a straight line (EI.2).

The skill to care was mainly displayed in invigilators ensuring that students were comfortable and assured of a 'presence in the room'(Lilley, Meere, & Barker, 2016), and were encouraged to review their answers and not rush to finish the exam too quickly.

Implications for exam invigilation policy and practice.

Firstly, given the current context of massive remote teaching and the likely drift towards more distance learning and teaching, the time has arrived for the training of invigilators in the further and higher education sector in the processes of invigilation mediated by a webcam, microphone and special software downloaded to students' computers (Lilley, Meere, & Barker, 2016). **Applying this idea necessitates rewriting and rethinking existing exam invigilation policies so making them relevant to the present happenings. Also, training should be incorporated in the yearly information sessions hosted by FE and HE institutions for existing and new invigilators.**

Secondly, this research shows that invigilators learn on the job and develop work-related knowledge and skills. What invigilators learn and the knowledge and skills they develop are made explicit via 'reflection-on-experience' or practice. In light of this, a welcome addition during invigilation training sessions would be to provide invigilators with the opportunity to reflect on the invigilation process. This addition would help them unearth tacit knowledge. Doing so would firstly signal to invigilators the importance of 'reflection-on-practice' or experience. This added reflective/educational component to training sessions would transform them from mere information sessions to reflective training exercises where participants are encouraged to use their critical reflective ability. This occurrence could also aid in raising the profile of such sessions in the minds of invigilators.

Finally, and as important, the creators of examination invigilation policies for secondary through higher education institutions should seize the opportunity to harvest the thoughts of invigilators. Harvesting could occur through formal and informal means and the information used to improve examination policies and procedures. **For example, involving invigilators in yearly examination planning meetings, training of new invigilators and in informal conversations about their experiences in the role.** This is important because invigilators are on the 'frontline'. For that reason, they have not only first-hand experience of working procedures but are developing work-related knowledge and skills that can be shared with those who are not on the frontline. This is an opportunity that, if fully utilised, could result in greater improvements in the planning, implementation and evaluation of the examination invigilation processes and procedures.

Study Limitations

Firstly, the main limitation of this study is that it was conducted with a small sample of EIs, a total of four, working in a single further education college in London. This occurrence limits the possible generalisation of the findings. **Secondly, readers may need to consider that the varied length of interview responses could cause a potential bias towards participants who gave more detail. This occurrence, however, had no negative impact on the findings and the overall aim and intention of the paper.**

Summary

The purpose of this qualitative study was two-fold: first, to show how 'reflection-on-experience' enacted through interviews can unearth the tacit work-related knowledge and skills exam invigilators developed on the job and, second, to continue redressing the lack of attention given to exam invigilators in the research literature.

The importance of the study rests in the fact that there is a paucity of research that examines the perspectives and role of exam invigilators and their work-related knowledge and skills developed on the job (Minott 2018 & 2020). The move to online teaching caused by the pandemic **has** implications for exam invigilation policy and practice. Therefore, the study aids in filling a literary gap, giving invigilators a 'voice' in the research literature, and displaying specifically, some work-related knowledge and skills developed while invigilating computer-based exams. Table A below summarizes the key findings of this study.

Table A: Summary of Key findings

Knowledge Developed on the Job	Skills developed on the Job
Participants viewed invigilating computer-based examinations as either 'easy' or 'demanding'.	Participants displayed procedural skills (discreetly directing students to the toilet and computer troubleshooting), and intangible skills (mental flexibility, care, and creativity).
Participants displayed knowing: the facets or procedures of exam invigilation (timekeeping, giving instructions, allowing rest, or toilet breaks), the characteristics of the students (special educational needs SEN), and computer and operational knowledge such as knowing about a USB stick and deleting a document, and who to call when there is a problem with a computer.	

Biographies

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