

# Elaborating on the pedagogical knowledge management process in clinical education: A grounded theory study

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## Research article

**Keywords:** pedagogical knowledge management, knowledge management, clinical education, grounded theory

**Posted Date:** January 22nd, 2020

**DOI:** <https://doi.org/10.21203/rs.2.21527/v1>

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# Abstract

**Background:** Pedagogical knowledge management (PKM) is contributory to professional development and the promotion of clinical education quality. An efficient PKM requires understanding the associated process and dimensions in clinical education. Therefore, this study aimed to explain the theoretical process of PKM.

**Methods:** This qualitative study used a grounded theory approach. The participants comprised 27 clinical teachers, who were affiliated with Birjand University of Medical Sciences and had the required experience or knowledge about medical education. They were selected via a purposive, theoretical sampling method and went through semi-structured interviews. The interviews were analyzed based on Corbin and Strauss's analytical approach (2008) through constant comparison of the data until the classes were saturated, and the grounded theory emerged. Ultimately, the rigor and trustworthiness of the research were assessed based on Lincoln and Guba's criteria.

**Results:** From the data analysis, 3615 primary codes and 7 core categories emerged. The results indicated that a psychosocial process governs the PKM of the faculty, which is affected by personal egos, inadequate and inappropriate learning of pedagogical knowledge, empirical practice, imbalance between multiple teacher tasks in clinical education due to the dominance of treatment over education, inappropriate knowledge organization and storage, and lack of optimal time management. Obvious consequences include the inability to create and apply pedagogical knowledge and clinical training based on trial and error.

**Conclusions:** The results of this article can be used for policy-making in clinical education to promote the PKM platforms, which ultimately leads to quality clinical education and community health promotion.

## Background

Pedagogical knowledge management (PKM) involves the management of knowledge and experiences in the fields of teaching, assessment, theories of learning, classroom management, and other areas of medical education. It can contribute to the professional development of teachers in medical sciences and, in turn, improve the quality of education [1]. The quality of higher education is a concern of significance in many countries [2]. It is because higher education is not only defused with the responsibility of helping students build and create knowledge, it also plays an essential role in creating insights, attitudes, and employment skills within the framework of the goals of the higher education system. With the increase in the number of higher education institutions, the quality of education has gained further interest and significance [3].

As part of the higher education system, medical education is of particular importance as it deals with the lives of people [4]. Improving educational practices, planning, and evaluation will lead to improved student learning and, in a broader scope, to the promotion of the health sector [5].

Teachers, as the most critical mainstay in the quality of education, need to have knowledge in different domains for their core task, i.e., education, which is essentially an intellectual activity [6]. This knowledge, known as pedagogical knowledge [7], can produce insight and awareness in the teacher in the context of culture and experience [8]. Thus, we can admit that faculty members create this knowledge [9] and use it in the process of teaching students. Faculty members can share their knowledge with their peers to pave the ground for professional development and thus provide a platform for promoting pedagogical knowledge [6, 10]. Hence, it is imperative that this knowledge be managed [11].

While faculty members attempt to develop professionalism, PKM provides a ground for maturity in medical education knowledge [12], where the use of this knowledge in the teaching-learning process will ultimately enhance the quality of education [13]. Jeremy believes that knowledge management can lead to more appropriate decision-making and evidence- and innovation-based actions [14]. Previous studies indicate that pedagogical knowledge in medical sciences is not managed correctly [15] and that faculty members' knowledge management is, to a lesser extent, based on practical and structural patterns, since medical education has often been overridden by medical duties [16]. It is also probable that knowledge management cannot be implemented as a process in clinical education. Under such circumstances, clinical education processes cannot be influenced by proper knowledge management and may be merely based on experience and trial and error. In other words, in the case of unstructured PKM, clinical education will not be founded on the teacher's rationality and experiences in line with the conditions governing the educational process. These factors can jeopardize the delivery of appropriate education. To solve these challenges requires elaborating on the current process of PKM in clinical education so that the ground is paved for the participation of policy-makers, leading to quality medical education and, eventually, the health of community members [14].

Several studies have been conducted on knowledge management in universities [17–19]. Moreover, the lack of a study on PKM in medical sciences, according to the researcher's survey, necessitates conducting a study on PKM. Accordingly, this study enquired qualitatively into the knowledge required for the PKM process, the obstacles, facilitators, and the associated consequences based upon the experiences of clinical teachers. From among qualitative methods, the grounded theory approach was selected because the PKM process is fulfilled in medical universities using symbols such as teaching, developing educational content, and educational research during social interactions. Knowledge management requires interpersonal interactions, and the formation and development of knowledge, including pedagogical knowledge, can presumably be realized in the context of these interactions. In the symbolic interaction, people typically assign symbols to each other [20], which is the basis of qualitative studies. Besides, studies indicate that knowledge management is in the pre-scientific period, and therefore, it is necessary to use an inductive approach upon which a theory can emerge from observation [21].

## Methods

The present work is a grounded theory project. The nature of PKM corresponds with what has been posited in symbolic interactionism, as there are interactions with individuals and the environment [20].

The participants were clinical teachers of Birjand University of Medical Sciences who had at least one year of clinical experience and a willingness to participate and provide rich experiences. The data were collected via semi-structured interviews, which continued until there was theoretical saturation. The interviews lasted from 30 to 107 minutes, and the participants decided where to have the interviews. Ethical considerations comprised of obtaining permission to enter the research setting; explaining the purpose of the study, the method of interviewing, and the voluntary nature of participation to the participants; assuring the participants of confidentiality and anonymity; obtaining informed consent for interviews and recording conversations; and having the right to withdraw from research at any time.

Data were concurrently collected and analyzed after the first interview was completed. The researcher wrote memos during data analysis. In this way, the collection and analysis led to the formation of concepts, and these concepts were used to design subsequent questions for data collection. The process continued until there was data saturation, i.e., the concepts were well defined and explained, connections between the concepts were clear, and no new concepts could be derived from new interviews. Data were analyzed through constant comparisons using analytical tools such as questions posed and comparisons made between intra- and inter-class concepts, which increased the theoretical sensitivity of the study.

To analyze the data, we used Corbin and Strauss (2008) approach [22], which involves analyzing the data to achieve concepts, contexts, processes, and the composition of the classes around a core variable with consideration of the primary concern of the participants and the emergence of grounded theory. Open coding was applied to specify the meaning of the data and axial coding to establish links among concepts and classes. Moreover, memos were written in the data analysis phase to specify the context. The causative conditions, contextual conditions, intervening conditions, and strategies were identified based on the paradigm pattern.

In the next step, the causal, contextual, and intervening conditions were connected as the structural conditions of the phenomenon and consequences in order to reach the process. The elaborated structure emerged in response to the main question of the research, "How do medical teachers manage their pedagogical knowledge?" Subsequently, one concern of the participants was identified as the fact that they were not professional in terms of PKM. Moreover, the background conditions effective in this phenomenon were identified, and the way these conditions affected PKM was explained.

In this study, Lincoln and Guba's criteria were used to validate the results and to confirm the trustworthiness and rigor of the data. Speziale, Streubert, and Carpenter (2011)[23], quoted by Lincoln and Guba, suggested four valid or acceptable criteria for assessing the rigor and trustworthiness of a qualitative study (Credibility denotes the correspondence between the data and the non-diversion and contradiction between them. It is equivalent to validity in quantitative research, i.e., the degree to which one can trust the realness of the findings for the participants in the research. To be credible, the data were reviewed by both the participants and faculty members working as supervisors and advisors in Birjand University of Medical Sciences. To achieve transferability, i.e., the degree to which the results can be

generalized or transferred to other contexts or situations, two measures were taken. First, the results were presented to some faculty members who did not participate in the study to examine transferability and their correspondence with the medical university context, and second, theoretical sampling was performed with maximum variation. Dependability is the third criterion of data robustness and is equal to reliability in quantitative research. It refers to the stability of the data or the consistency of the current data and those collected by other researchers. Alongside this, the recorded interviews were compared with the transcriptions, and concrete questions were used. Confirmability is the fourth criterion for the quality of qualitative research and denotes the degree to which the results could be confirmed or corroborated by others. It can be reached by demonstrating that the findings are, in effect, based on the data. For this purpose, peer feedback was obtained, i.e., the data were given to a researcher who was not related to the study to see if s/he would have a similar understanding of the data and whether s/he derives the same from the data. Moreover, all the steps were recorded in detail.

## Results

The participants were 27 individuals, including 17 women and ten men, ranging in age from 33 to 55 years. They had between 2 years and 25 years of tenure and were all involved with clinical education.

The findings of the study consisted of 3,615 initial codes and seven core categories. PKM was identified as the phenomenon, the use of PKM skills as the causative conditions, PKM platforms as background conditions, low maturity level in PNM as the confining condition, and the professional support of PNM as the facilitating conditions. Moreover, the participants were working to reach maturity in PKM, which resulted in numerous consequences (Table 1).

### The PKM phenomenon

Some of the faculties practiced PKM by identifying and acquiring knowledge, sharing and assessing knowledge, applying knowledge, organizing and storing knowledge, creating knowledge, and securing knowledge.

Identifying and acquiring pedagogical knowledge is a function of familiarity with PKM fundamentals. The first condition for knowledge management, according to the participants, was to identify the sources of information and to have a proper understanding of pedagogical knowledge. To acquire knowledge, the faculties required actions such as personal study, education, teacher training, experiential learning, informal education, formal training, faculty guidance, knowledge acquisition from colleagues, acquisition of knowledge from students, and acquisition of knowledge from experts. Moreover, they considered patients as a source for knowledge acquisition.

One of the participants stated:

[One of the ways through which I came to learn the medical education knowledge] was to study the story of those involved in teaching and education and see video clips about such issues, for example, the TED,

which one can learn from.

(Participant # 19)

The sharing of pedagogical knowledge in clinical education is a widespread phenomenon in medical universities, which can be found in a wide range of educational activities. The participants enumerated knowledge sharing in the fields of education, peers, scientific products, professional networks, scientific communities of administrative communications, virtual networks, and students as knowledge sharing methods.

I learned communication skills as a pedagogical knowledge from students because I saw them complaining of the way some teachers treated them; thus, I understood what to consider when I was dealing with students.

(Participant # 9)

After the knowledge is identified and acquired, it is imperative that the collected knowledge be assessed and evaluated. The newly produced or acquired knowledge must be evaluated to ensure its credibility and value before it can be shared, especially because pedagogical knowledge used in the educational environment can leave a profound influence. To assess it, nevertheless, most of the participants used the knowledge in the real environment and examined the result. Among other methods of assessing pedagogical knowledge were the assessment from the perspective of clients, expert assessment, peer assessment, 360-degree assessment, self-assessment, and external evaluation. One of the participants stated:

I should have evaluated using another model. When I evaluated the students and examined the results, I would ask myself what could be underlying these poor results. Either the student has had a problem, or my education or assessment method has not been appropriate.

(Participant # 9)

The application of knowledge refers to the use of knowledge for solving problems and making decisions; the application of pedagogical knowledge denotes the use of pedagogical knowledge by the teacher throughout the training process. Participants believed that pedagogical knowledge could be used for student evaluation, advice, and counseling, peer education, and the educational process [a research project on an educational issue implemented in practice over a year].

When I attended test designing programs, I figured out how problematic the questions that I had designed were; I did not follow much of the rules, and I did not know that the rules were so important.

(Participant # 25)

Organizing and storing pedagogical knowledge refers to issues such as prioritization; the classification of knowledge and information; the recording of information (documentation); the preservation, storage, and

maintenance of information; and updating knowledge. An individual should establish interrelationships between the elements by combining and classifying them and hence facilitate the accessibility of the knowledge for those in need. Based on their experience, the participants organized pedagogical knowledge in virtual networks, notebooks, information organization software applications, personal folders, books, and flashcards. Concerning the place for storing and maintaining pedagogical knowledge and information, the participants cited spaces such as flash memories, contents printed, CDs or tapes, mobile phones, computers, emails, personal drives, laptops, photo prints, and tablets. Moreover, the participants classified their pedagogical knowledge and information in terms of subject, title, educational semesters, and the need for access; for prioritization, they considered the importance, personal needs in the learning process, personal interest, and the application of the experience.

In terms of recording experiences in the notebook, one participant stated:

I now have two or three notebooks in which I record some of the events that occur during the day. Some are simple things. For example, one of the colleagues may have done something. [...] I wonder whether what was done was the right thing to do or not. [...] So I write it down in my notebook and note, for example, that Dr. X did it. I look for the right answer to see what is right, and why s/he did it at all.

(Participant # 24)

Knowledge creation is the process of creating or updating knowledge. Participants' experiences showed that three perspectives govern the creation of pedagogical knowledge in medical science: the creation of knowledge with an emphasis on explicit knowledge, the creation of knowledge with a focus on tacit knowledge, and a view opposing short-term knowledge creation.

Contrary to the two previous views, the latter is believed by some contributors not to be the creation of pedagogical knowledge, with examples including writing a paper, an educational process, or educational experience. They perceive it as a short-sighted perspective on the creation of pedagogical knowledge. One of the participants mentioned what follows.

I have published two papers on PubMed on new methods of teaching, but they cannot be counted as knowledge creation. I think that knowledge creation should add to the current knowledge level. For example, in my study, I compared nurses' reporting competence via the conventional continuing medical education and the electronic method; but, in my opinion, this is the application of knowledge. For my thesis, I now intend to produce an educational method and give a theory; it may now be possible to claim that the creation of knowledge has happened.

(Participant # 10)

### **Using PKM skills (causative conditions)**

The faculty members believed that the necessary condition for knowledge management involved the application of knowledge management skills such as searching and acquiring knowledge, utilizing

experiences, effective interaction, computer skills, knowledge organizing skill, comprehensive assessment of knowledge skill, teamwork skill, pedagogical knowledge recognition skill, knowledge utilization skill, knowledge transfer skill, and time management skill. Participants' experiences showed that using these skills varied in different places and times. As part of their clinical learning experiences, the participants perceived that one required to have a high level of competence for searching knowledge in different sources as well as a probing spirit, competency in international languages, and identification of knowledge bases to acquire pedagogical knowledge.

One of the participants said:

The individual must have this skill and interest to search all the sources, as you would do in the case of a systematic review when you do it comprehensively. You will include articles, you include books, theses, journals, red and yellow papers, but you may even include TV and news interviews and newspapers. All of these are sources of information.

(Participant # 19)

### **PKM Platforms (Background Conditions)**

The faculties acknowledged that their PKM was formed in contexts such as individual, organizational, educational, and cultural. Each of these contributed to the occurrence of the PKM phenomenon.

Participants pointed to the individual-level grounds, including the teacher's motivation, individual characteristics, attitudes, and personal beliefs of the teacher.

If I am motivated, I can read books, attend short-term courses, and participate in workshops. I have to have the motivation, but it is difficult – it is difficult for those in clinical settings. It is because the clinic provides stronger motivations, where you see one patient and the money that you will receive. The money is not substantial, but it is money anyhow. However, you cannot tell the same story about education. If you have ten students or 200 students, the money you receive is the same, so there is no incentive to enhance anything. I present the same material as before.

(Participant # 3)

Concerning the educational context, the faculties mentioned the students' educational demands and the conditions governing the pedagogical knowledge education. The students' sense of demand was expressed in terms of students' motivation to learn, request from the faculty, and students' morale. One of the faculties said:

The student attending my class, if s/he does not demand me, I will not search for new strategies; to the same extent that students demand me and request for further requirements, I'll check myself out.

(Participant # 24)

Regarding the role of the organization, as the institutional platform in PKM, some of the faculties pointed to the educational leader, educational policy-making and legislation, monitoring and evaluation, faculty selection, and payment policies.

For the educational leader, the faculties referred to concepts such as the presence of leading teachers, charismatic leader, and department head's attempts to hold productive group meetings, and the creation of an atmosphere of collaboration among the department members by the department head. One participant stated:

Some faculty members will come to have educational charisma for others. When someone new to the college sees some faculties with high-level charisma, the newcomers will see them as models to follow and will use the same educational methods that charismatic people employ in education.

(Participant # 19)

In the experiences of the participants, the culture dominating the clinical education environment, the culture governing the faculty members, and the culture governing the top managers of the organization are contributors to PKM.

Regarding the role of the culture governing the clinical education environment in creating a learning environment, the participants referred to a number of issues as cultural barriers to knowledge management. They comprised of individualism, lack of people's support for sharing and acquiring knowledge, non-institutionalization of learning from peers, non-acceptance of learning from colleagues in the university, low respect for education by some faculty members, presentation of education on the cyberspace as insignificant by the faculty, joint meetings held without bias, and a monotonous environment. They emphasized the non-dominance of power hierarchy, preference for group promotion over individual promotion, and recognition of education as important in formal meetings as contributors to PKM.

As regards the atmosphere and the environment governing the institution as the basis for sharing knowledge, one of the participants stated:

In order to share knowledge, I think the atmosphere is the most important thing; the important thing is what kind of atmosphere dominates the institution, whether it is a boss-employee atmosphere, whether it is a newcomer-experienced climate, or whether it is a learning environment. That is important because universities aim actually at having this teaching-learning process. The climate should be constructed so that a person who has a year of tenure and someone with years of tenure does not have a top-down perspective. No hierarchy of power should exist, but there should be a participatory learning climate, and the goal should be effective promotion. If it is so, along with the institution's promotion, there will definitely occur individualistic promotion as well.

(Participant # 10)

## **PKM infrastructure or supporters (Facilitating conditions)**

The concept derived from the experience of the participants was support as the facilitator to their strategies for PKM. In fact, it can be considered equivalent to the necessary infrastructure, a term commonly used in the context of organizational knowledge management. It seems that when it comes to individualized knowledge management, support can be a more appropriate term. The supports may include cultural support, the provision of educational equipment and facilities, educational support, system support, and the provision of the required information resources.

According to the participants, cultural support is one of the critical principles in PKM as it creates a learning climate and values experiences. Creating a learning culture through sensitization, producing a learning environment, establishing a teamwork atmosphere, creating an atmosphere of expressing comments about learning without fear and humiliation, and monitoring the atmosphere of training sessions can provide a desirable learning environment for PKM.

One of the participants explained the need to create a learning environment as follows.

Individuals should come into the working arena who have the motivation; I mean, they should be initially motivated. That is, s/he should be advised of who s/he is and be oriented to the type of person s/he should be. It is because we are sometimes one thing but must be another thing. We are not what we should be. See, for example, that I am an anesthesiologist and should have a set of attributes. First, for me, there must be a scientific environment, that is, everywhere must be fused with science; wherever you go, you should feel that everyone is a scientist and researcher. You can see how good it feels. And then imagine that you're loved, and the love in the workplace (in terms of science), it means that everybody wants to work for a unified goal and without personal hostility.

(Participant # 4)

In the experience of some of the participants, provision of equipment and educational facilities paves the way for the acquisition, sharing, and application of knowledge. Upgrading educational and training equipment and providing specialized working forces in education facilitate PKM. As for upgrading educational equipment, one of the faculties stated:

The infrastructure, I mean the context, should be prepared so that I can use different learning methods; for example, I'm in the operating room trying to show an educational video. There is no computer, no video projector, no educational facilities, no nothing.

(Participant # 9)

According to some faculty members, educational support is essential through educational supervision, support for continuing medical education of the faculty members, and training provided during the residency in the form of course credits for PKM development. Educational supervision facilitates PKM.

Education on pedagogical knowledge as part of the curriculum during studies at the university is also a facilitator of PKM. One of the participants stated:

We need to teach students how to become teachers during the residency program.

(Participant # 20)

According to some participants, system support refers to an organization's support for PKM, which is manifested through setting targets, planning, incentive and monetary policy-making, and regulatory requirements. When an organization specifies targets for the system's performance, it creates an intrinsic motive for PKM. On the other hand, a redefinition of medical philosophy as associated with setting targets strengthened this motivation, because it emphasized constructivism and innovation of individuals, and thus supported PKM. In terms of incentive and monetary policy-making, the participants shared experiences in the form of concepts such as financial payment in accordance with educational activities, the benefits given for courses based on the skills and abilities of the teacher, the effect of performance on the benefits received, and the impact of education quality on financial gains, which can support PKM by motivating the faculty members. One participant said:

My monthly merit pay should be a function of my educational activities, which means that if I am evaluated concerning my educational activities and get a high score, the merit pay should be multiplied by this coefficient. If I, as a faculty member, devote my time to education, my merit pay coefficient should be 90%, and someone who disregards education, the coefficient should be 30%. Perhaps the law also predicts something, but this does not happen. I suspect that the coefficients of the merit pay are not updated, while, I believe, the merit pay system should be planned such that every three to six months, the percentage given to physicians be partly associated with their educational efficacy.

(Participant # 12)

### **Low PKM maturity level (Context governing the phenomenon)**

The study found that the low level of PKM maturity and its subcategories constitute the governing context of PKM for clinical teachers affiliated with medical universities. The subcategories include personal egos, inadequate and inappropriate acquisition of pedagogical knowledge, experiential performance, an imbalance between multiple tasks of the teacher, inadequate knowledge organization and storage, and lack of optimal time management. In their expression of personal egos, some of the faculty members were dissatisfied with the governing thought in medical universities, where pedagogical knowledge is regarded as personal wealth. They were also displeased with the perception of wisdom dominating the culture of faculties in medical universities. In this regard, one of the faculties stated:

The teachers are reluctant to learn in the field of education because they think they know everything. They do not accept what others may say.

(Participant # 9)

Concerning the inadequate and inappropriate acquisition of pedagogical knowledge, one of the participants stated:

Well, we do not know where to find the treatment. When you come and say that these methods will improve the quality of education, one may exclaim, "How interesting! I did not know that there is such a method". For example, I have heard of curriculum disease for the first time.

(Participant # 14)

Regarding experiential practice as the governing context for clinical education in medical sciences, a faculty member states that:

My experience comes from the time I was a student; in the same way that I was given the tests and I was taught, I am teaching and testing my students.

(Participant # 1)

As concerns with the lack of search for pedagogical knowledge, another participant acknowledged that:

Unfortunately, some colleagues are not only afraid to share, but also do not attend meetings where new materials are presented, and they are not even willing to change their behavior and teaching methods.

(Participant # 13)

In connection with the imbalance between a teacher's multiple tasks, another participant said:

There is a bit of confusion in clinical education because therapeutic work and educational work are mixed, which means that I, as a radiologist, have too much work to do. It's really not possible to allocate too much time for education. So, you do not know how to regulate the time so that neither of the two fields is overlooked.

(Participant # 23)

Some of the faculties stated that the inappropriate organization of experiences and merely committing them to memory terminated these experiences:

I have not yet come up with the idea of writing down on paper. I never wrote the formula of how to do it on paper. In fact, I implemented as a simple method what was on my mind.

(Participant # 21)

Some of the faculty members did not have enough time to acquire and share knowledge due to a lack of time management. One of the participants stated:

We do not have enough time to talk about this, I mean, for certain hours. Well, we spend many hours sitting with my husband, talking at home and talking about it; but with colleagues, there is no chance to sit and talk about what's going on. Otherwise, we have no problem with consulting, for example.

(Participant # 17)

### **Attempts to promote PKM maturity level (Procedure)**

The category of attempts to improve the PKM maturity level involved a set of subcategories, including attempts to gain credible knowledge, attempts to use effective educational interventions, attempts to gain the skills needed for PKM, attempts for professional performance in education, attempts to change the educational process based on pedagogical knowledge, attempts for appropriate knowledge transfer and sharing, attempts to appropriately record and organize knowledge, assessment of knowledge to improve it, and attempts to create knowledge. Building on these, the participants tried to overcome the problem of maturity in PKM and improve their PKM level.

In the context of efforts to gain credible knowledge, one of the faculties said:

When I come across interesting stuff, I'll definitely read it and let two or more peers know of it. I try to increase my knowledge if it's not challenging. If an issue is a challenge for me or if I need to solve a problem, I definitely ask my teachers or study about it.

(Participant # 10)

In their efforts to use effective educational interventions, the faculties pointed to the use of tacit and explicit knowledge:

I use the findings or products of research on medical education or educational processes that have had good results in my practice.

(Participant # 9)

As regards attempts to gain the skills required for PKM, another faculty member mentioned:

Some new ways are introduced; for example, I have friends who are IT professionals. Because I'm interested in IT, I work with them.

(Participant # 19)

Attempting for professional performance in education, some participants tried to provide the context for PKM-associated activities by inducing internal incentives and doing professional behaviors for PKM since it was believed that knowledge management was a psychosocial process that creates a stimulant for PKM by creating an internal force.

Some of the faculties aimed for PKM by modifying their beliefs and relying on religious and cultural beliefs. It was emphasized by one of the participants that sharing knowledge is Zakat of science:

So, in fact, I have to pay its *Zakat*. When I feel that I have the ability in a certain field of medical education that I am so competent to be satisfied with it myself, I'll definitely try to teach it to others. This I consider my religious duty.

(Participant # 4)

The majority of the participants believed that faculty members had no interest in changing the clinical education process based on pedagogical knowledge. In this regard, some of the participants referred to individualistic efforts for change, and others tried to attract colleagues. One of the participants said:

I will first introduce the assessment or teaching method that I have recently learned in the department. If the group agrees, then we will change our old method.

(Participant # 22)

The vast majority of the participants were trying to transfer and share knowledge appropriately with the aim of transferring knowledge to solve the educational problems of colleagues and trying to share knowledge with colleagues with the aim of their professional development. Concerning teaching new evaluation methods to colleagues, one of the participants maintained that

In our department, I suggested that we give the OSCE exam, but the questions that the professors presented were for a written test; however much I explained that these questions were not okay, they would not accept it. It is hard to tell someone that they are not well aware of something and to teach them. This is not something to be done by force.

(Participant # 3)

Some of the participants tried to organize pedagogical knowledge by recording and organizing disparate knowledge. They sought to employ strategies such as recording educational experiences on Instagram, accuracy in organizing information, attempts for proper organization, registering personal observations, recording attractive experiences on Telegram, registration on specialized websites, recording the knowledge derived from participation in scientific conferences in notebooks, recording educational events, proper organization of the results to search and research about the observed ideas, and recording errors made by others and accuracy with evading the same in education. For recording peers' errors and the accuracy with evading them in education, one of the faculty members stated:

I have seen many things done by my colleague. Some were done correctly and some incorrectly. Those that are performed correctly, I try to follow. Those that are wrongly performed, I put a check beside in order not to repeat.

(Participant # 24)

To improve the clinical education process, the faculty members took a set of measures. Examples include doing research on the recorded educational events, searching for sources of knowledge, assessing new knowledge in line with working conditions and scope, reviewing the applicability of pedagogical knowledge, evaluating educational workshops, doing self-assessment and making changes in the routines, participating in question formulation sessions, using feedback for educational activities, making changes in student evaluation, assessing the implementation of educational methods from the viewpoint of colleagues, reviewing workshop-related problems with colleagues, and surveying students. Concerning doing self-assessment and making changes, one participant mentioned what follows.

I came to conclude that my method of teaching was not very interesting. I told the students that it would not be right for me to be the only speaker in class and that they should start to have more active participation. Thus, they prepare the materials according to the syllabus and present the materials. I complement the presentations. This method, I think, was much more successful.

(Participant # 11)

Creating pedagogical knowledge was much more difficult by those who did not have the necessary expertise in pedagogical knowledge, but they were striving to develop knowledge through the development of an educational method or an educational process, and publication of educational bulletins, i.e., a measure that takes place after the acquisition of pedagogical knowledge.

One of the participants stated that:

Now for my thesis, I'm going to produce an educational method and develop a theory. I can now claim that knowledge is created. How much it can prove, of course, is a matter of debate.

(Participant # 10)

### **Outcomes of relative maturity in PKM**

Attempts to improve PKM maturity level had implications with concepts such as improving education quality and revolutionizing education, promoting student satisfaction and learning, promoting job satisfaction and professional development of faculty members, and ultimately improving the quality of health services. These outcomes were relative because whenever professional support was provided, the teachers' efforts to promote maturity were fruitful, and whenever maturity was of a low level, their efforts were limited.

In relation to improving education quality and its revolution, one of the faculties stated:

Upgraded knowledge can illuminate the future of individuals, and they must follow certain paths to reach that horizon. This knowledge management illuminates the path to people.

(Participant # 12)

One of the outcomes of the faculties' efforts to professionalize is the enhanced satisfaction and learning of students. In this regard and with the promotion of students' satisfaction as an outcome of PKM, the participants referred to the students' future pathways, better recognition, and satisfaction. One of the participants stated this as follows.

It makes much difference, that is, students will be absorbed in a class where the instructor is competent in knowledge management skills related to medical education. They do not want the class to finish.

(Participant # 18)

Professional development and job satisfaction were hallmarks of PKM. A participant said:

It feels terrific. I mean, we have something called motivational satisfaction, which I think is very important during the middle age. Perhaps, not all people are perfectionists and idealistic; however, they will feel satisfied with what they have done so far in education.

(Participant # 23)

## Discussion

According to the literature, the starting point for knowledge management is to identify knowledge [24]. In this study, the PKM process began with the identification of knowledge. Knowledge is acquired, and subsequently, pedagogical knowledge is assessed and used in practice. The results are shared, concurrently organized and stored, and, if necessary, knowledge security strategies are taken, although the latter is less applicable to pedagogical knowledge. Ultimately, pedagogical knowledge is created in its implicit meaning, while in its explicit meaning, it is rarely created as noted by Weda (2018) [25]. The results of this study are consistent with the findings from Leung (2010), who reviewed teachers' perceptions of knowledge management. In Leung's study, knowledge creation and acquisition by teachers were ignored, which is also a major category in our study and one of the indicators for the low PKM maturity level of the faculty [26].

PKM skills were considered among causal conditions. Jain (2011) maintains that these skills, including knowledge management skills and attitude, are simultaneously effective on performance [27].

PKM's supports were identified to include cultural support, the provision of educational equipment and facilities, educational support, system support, and the provision of the required information resources. Technology in the academic community has a pivotal role to play in supporting communication, collaboration, and the search for knowledge and information. The utilization of technology at universities facilitates the possibility of performing many knowledge management activities, such as knowledge recording, storage, and transfer. According to Ahmady et al. (2012), however, technology is conducive to the process of information processing and knowledge management to a lesser extent than other influential factors such as culture [28].

Among the system supports are rewards and financial payment, where, according to Tan and Noor (2013), organizational rewards have a positive impact on the prediction of knowledge sharing and commitment [29]. Moreover, the educational support identified in this study provides the context for implementing the PKM [30].

Educational leaders, as one of the components of organizational support, are influential in the formation of organizational culture and can play a key role in shaping, encouraging, and maintaining a knowledge-based culture [31]. The working climate is another important factor in knowledge creation [32]. Siyadat et al. (2010) added that social interaction, organizational culture, and social capital are significant contributors to knowledge creation [33]. The study also showed that the fear of plagiarism would lead to the preservation of tacit knowledge among faculty members and prevent the transfer of knowledge. This was among the causes for low PKM maturity, while Enakrire and Uloma's study (2012) suggests that tacit knowledge exchange will improve teaching and learning [34].

One of the outcomes of PKM was student learning and satisfaction. Biasutti and Heba (2012) reported that knowledge sharing among faculty members paves the way for student satisfaction and learning, the cause of which may be the promoted knowledge of faculty members due to the sharing of knowledge [35]. Zheng et al. (2010) also acknowledged that knowledge management affects the efficacy of teachers and that one outcome of PKM was to improve the quality of teaching [36]. Empirical research in Devi Ramachandran et al. (2013) showed that knowledge transmission and coding correlate with the performance of individuals [37].

#### Theoretical implications of the study

The problem of clinical teachers in medical sciences regarding PKM emerges in the form of personal egos, as termed by Elezi and Bamber (2018), inadequate and inappropriate learning of pedagogical knowledge, inadequate and inappropriate learning of pedagogical knowledge, empirical practice, imbalance between multiple teacher tasks in clinical education due to the dominance of treatment over education, inappropriate knowledge organization and storage, and lack of optimal time management [38]. Various reasons may underlie these problems, including a lack of specialized staff, financial incentives in the treatment sector, and lack of expertise in pedagogical knowledge, which are also mentioned in other studies [16]. Its obvious consequence is the inability to create pedagogical knowledge derived from the educational environment, as confirmed by Weda (2018), and Leung (2010) [25, 26]. As a result, clinical teaching processes may not be a product of appropriate PKM and, in most cases, be merely based on experience and trial and error.

Teachers' experiences showed that a psychosocial process governs PKM in clinical education. In fact, none of the strategies used by the clinical teachers, including attempt to gain credible knowledge, attempts to use effective educational interventions, attempts to gain the skills needed for PKM, attempts for professional performance in education, attempts to change the educational process based on pedagogical knowledge, and attempts for appropriate knowledge transfer and sharing, among others, can per se warrant a teacher's overcome over problems. For example, one teacher might be trained in

pedagogical knowledge, but s/he may not be willing to share or use the knowledge. Alongside this, motivation has been highlighted as one of the components of the individualized context [39]. Teachers may also happen to be insufficiently familiar with the pedagogical knowledge sources of information and do not personally seek knowledge, although they may be skilled in seeking information resources. Therefore, the requisite condition for PKM was the co-occurrence of all the proposed solutions.

Another important point in this psychosocial process was to prioritize the use of these strategies. The participants believed that it was necessary at the outset to develop the necessary skills for PKM. Effective educational interventions in the field of pedagogical knowledge need to follow, and simultaneously, the motivation and belief in a change in the educational process or the use of pedagogical knowledge should be induced in the teacher. A motivated, trained, and skilled teacher can subsequently handle appropriate PKM because inclination is the driving force for knowledge management behaviors. Jain (2011) also maintain that attitude and skill are simultaneously effectual in performance [27]. A self-confident teacher armed with pedagogical knowledge acquisition skills can play an active role in the sharing and use of pedagogical knowledge, and ultimately create this knowledge, which will lead to the teacher's professionalization and promoted maturity in PKM.

Limitations of the study: This study is a qualitative one, and the findings may not be easily transferrable to other situations. Another limitation may concern with the researcher's background in Birjand University of Medical Sciences and working experience with the faculties at the Education Development Center, which may have affected the interpretation and emergence of concepts derived from the data. The argument is that the presence of the researcher in a natural environment is not entirely controllable; however, the researcher attempted to employ the experiences for understanding the problem rather than influencing the data.

## Conclusions

This article presented the results of a qualitative inquiry into the PKM process in clinical education. Both the PKM cycle and the problems and challenges involved in the process were identified. We found that substandard knowledge management skills and non-professionalism in PKM underlie incorrect or incomplete PKM, which demands educational support to improve. This problem occurs to a greater extent in poor contextual conditions. The faculty can manage their pedagogical knowledge properly when professional support is provided as a facilitator. Knowledge is nevertheless rarely created by the faculty in its explicit sense because the faculty are hardly professional in pedagogical knowledge. In fact, in many cases, the tacit pedagogical knowledge is also either ignored or left unrecorded.

Another issue to be considered is that PKM takes place in a variety of platforms, including individualistic, educational, cultural, and organizational, and the preparation of these platforms will guarantee PKM success to some extent. These platforms are in an interactive association. For example, a teacher's motivation, intrinsic ability, attitudes, and beliefs, constituting the individualistic platform, lead to varying PKM manifestations in the faculty. However, motivational and payment policies and supervision can

affect the individualistic platform, leading to a proper cultural platform for the use of PKM. This can determine the activity route map for the faculty, particularly the newly recruited faculty who will be most benefited. Payment policies also confirm the organization's efforts to encourage effective clinical education, which can institutionalize among the faculty that the foremost task is to train and that other tasks should be in line with this critical undertaking.

As a result, this study reveals that the pavement of PKM platforms can help teachers in medical universities to base clinical education activities on pedagogical knowledge. Basic steps in this regard include specialized training in pedagogical knowledge and knowledge management skills, education-based policy-making, enculturation, and supervision of the educational process.

## **Declarations**

### **Ethics approval and consent to participate**

Approval was granted by the Iranian national committee for Ethics in Biomedical Research (Ethics Committee of University of Birjand ,IR.BIRJAND.REC.1398.002).All participants gave written informed consent to participate.

### **Consent for publication**

Participants were assured in the consent form they signed that the publication of the data would not indicate their names or any identifying information.

### **Availability of data and materials**

The datasets used during the current study (initial codes) are available from the corresponding author on a reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

This study is a product of a doctoral dissertation thesis (code number # 1431210) approved at the University of Birjand, but the design of the study, data collection, analysis, interpretation and writing was entirely the responsibility of the authors.

### **Authors' contributions**

The listed authors helped significantly to prepare the contents. KR and MA conceptualized the research idea, KR, collected the data, coordinated the research team, contributed to the analysis, and drafted the

manuscript. MA and FA conducted the qualitative analysis and drafted the manuscript; HSH revised the manuscript. All authors read and approved the final manuscript.

## Acknowledgments

We are grateful to all those who helped us with this research.

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## Abbreviations

PKM: pedagogical knowledge management

## References

1. Irby DM. Excellence in clinical teaching: knowledge transformation and development required. *Medical education*. 2014 Aug;48(8):776-84.
2. Zwanikken, P.A.C., Peterhans, B., Dardis, L. et al. Quality assurance in transnational higher education: a case study of the tropEd network. *BMC Med Educ* 13, 43 (2013) doi:10.1186/1472-6920-13-43
3. Wisniewska M, Grudowski P. High-quality academic teachers in business school. The case of The University of Gdańsk, Poland. *Total Quality Management & Business Excellence*. 2016;27(9):1158-70.
4. Pagnucci N, Carnevale FA, Bagnasco A, Tolotti A, Cadorin L, Sasso L. A cross-sectional study of pedagogical strategies in nursing education: opportunities and constraints toward using effective pedagogy. *BMC medical education*. 2015 Dec;15(1):138.
5. Hahn RA, Truman BI. Education improves public health and promotes health equity. *International journal of health services*. 2015 Oct;45(4):657-78.
6. Harr N, Eichler A, Renkl A. Integrating pedagogical content knowledge and pedagogical/psychological knowledge in mathematics. *Frontiers in Psychology*. 2014 Aug 20;5:924.
7. Harr N, Eichler A, Renkl A. Integrated learning: Ways of fostering the applicability of teachers' pedagogical and psychological knowledge. *Frontiers in psychology*. 2015 Jun 2;6:738.
8. Connelly FM, Xu SJ. Being practical with Schwab: Research and teaching in the foothills of curriculum. *Proceedings of The Practical: An East-West Curriculum Dialogue (Beijing: Capital Normal University)*. 2009:103-9.

9. Top LM, Schoonraad SA, Otero VK. Development of pedagogical knowledge among learning assistants. *International journal of STEM education*. 2018 Dec;5(1):1.
10. Moreau KA, Eady K, Sikora L, Horsley T. Digital storytelling in health professions education: a systematic review. *BMC medical education*. 2018 Dec;18(1):208.
11. Babar MA, Jummani NB, Mahmood ST, Amin S, Uddin H. Knowledge Management practices: Teachers perception. *European Scientific Journal, ESJ*. 2016 Sep 30;12(25):365.
12. Zhao J. School knowledge management framework and strategies: The new perspective on teacher professional development. *Computers in human behavior*. 2010 Mar 1;26(2):168-75.
13. Cheng EC. A Knowledge Management Model for School Development. In *Knowledge Management for School Education 2015* (pp. 71-83). Springer, Singapore.
14. Shahmoradi L, Safadari R, Jimma W. Knowledge management implementation and the tools utilized in healthcare for evidence-based decision making: a systematic review. *Ethiopian journal of health sciences*. 2017;27(5):541-58.
15. Costa NMdSC. Pedagogical training of medicine professors. *Revista latino-americana de enfermagem*. 2010;18(1):102-8.
16. Hoffman KG, Donaldson JF. Contextual tensions of the clinical environment and their influence on teaching and learning. *Medical education*. 2004 Apr;38(4):448-54.
17. Blackman D, Kennedy M. Knowledge management and effective university governance. *Journal of Knowledge Management*. 2009 Oct 23;13(6):547-63.
18. Fernández-López S, Rodeiro-Pazos D, Calvo N, Rodríguez-Gulías MJ. The effect of strategic knowledge management on the universities' performance: an empirical approach. *Journal of Knowledge management*. 2018 Apr 9;22(3):567-86.
19. Fullwood R, Rowley J, Delbridge R. Knowledge sharing amongst academics in UK universities. *Journal of knowledge management*. 2013 Feb 15;17(1):123-36.
20. Romano M, Del Giudice M, Nicotra M. Knowledge creation and exploitation in Italian universities: the role of internal policies for patent activity. *Journal of Knowledge Management*. 2014 Sep 2;18(5):952-70.
21. Schreiber, R.S. and Stern, P.N. eds. *Using grounded theory in nursing*. Springer Publishing Company, 2001.
22. Corbin J, Strauss A. Strategies for qualitative data analysis. *Basics of Qualitative Research. Techniques and procedures for developing grounded theory*. 2008;3.
23. Speziale HS, Streubert HJ, Carpenter DR. *Qualitative research in nursing: Advancing the humanistic imperative*. Lippincott Williams & Wilkins; 2011.
24. Herrero Á, Corchado E, Saiz LO, Abraham A. DIPKIP: a connectionist knowledge management system to identify knowledge deficits in practical cases. *Computational Intelligence*. 2010 Feb;26(1):26-56.
25. Weda S. The Effects of Knowledge Management on Performance of Government Employees (ASN) at Faculty of Languages and Literature State University of Makassar Indonesia. *International Journal*

- of Academic Research in Business and Social Sciences.2018; 8(4): 521-542.
26. Leung CH. Critical factors of implementing knowledge management in school environment: A qualitative study in Hong Kong. *Research Journal of Information Technology*. 2010;2(2):66-80.
  27. Jain P. Personal knowledge management: the foundation of organisational knowledge management. *South African Journal of Libraries and Information Science*. 2011 Jan 1;77(1):1-4.
  28. Ahmady GA, Nikooravesh A, Mehrpour M. Effect of organizational culture on knowledge management based on Denison model. *Procedia-Social and Behavioral Sciences*. 2016 Sep 12;230:387-95.
  29. Tan CN, Md. Noor S. Knowledge management enablers, knowledge sharing and research collaboration: a study of knowledge management at research universities in Malaysia. *Asian Journal of Technology Innovation*. 2013 Dec 1;21(2):251-76.
  30. Chumjit S. Knowledge management in higher education in thailand. (Doctoral dissertation).2013. Available from ProQuest Dissertations and Theses database. (UMI No.3553606).
  31. Opfer VD, Pedder DJ, Lavicza Z. The influence of school orientation to learning on teachers' professional learning change. *School Effectiveness and School Improvement*. 2011 Jun 1;22(2):193-214.
  32. Sveiby KE, Simons R. Collaborative climate and effectiveness of knowledge work–an empirical study. *Journal of knowledge Management*. 2002 Dec 1;6(5):420-33.
  33. Siadat SA, Hoveida R, Abbaszadeh M, Moghtadaie L. Knowledge creation in universities and some related factors. *Journal of Management Development*. 2012 Aug 10;31(8):845-72.
  34. Enakrire RT, Uloma NG. The Effect of Tacit Knowledge for Effective Teaching and Learning Processes among Lecturers at the Delta State University, Abraka. *Library Philosophy & Practice*. 2012 Aug 1.
  35. Biasutti M, Heba ED. Using Wiki in teacher education: Impact on knowledge management processes and student satisfaction. *Comput Educ* 2012; 59(3): 861-72.
  36. Zheng Y, Liu J, George G. The dynamic impact of innovative capability and inter-firm network on firm valuation: A longitudinal study of biotechnology start-ups. *Journal of Business Venturing*. 2010 Nov 1;25(6):593-609.
  37. Devi Ramachandran S, Chong SC, Wong KY. Knowledge management practices and enablers in public universities: A gap analysis. *Campus-Wide Information Systems*. 2013 Mar 21;30(2):76-94.
  38. Elezi E, Bamber C. Empirical Analysis of Knowledge Exchange in Higher Education Partnerships: Using Knowledge Elicitation Methods and Techniques. *Management Dynamics in the Knowledge Economy*. 2018 Dec 28;6(4):609-25.
  39. Veer Ramjeawon P, Rowley J. Knowledge management in higher education institutions: enablers and barriers in Mauritius. *The Learning Organization*. 2017 Jul 10;24(5):366-77.

## Table

**Table 1. Main categories and sub-categories emerged in the study regarding pedagogical knowledge management**

Sub-categories	Main categories
knowledge acquisition and learning, knowledge sharing and transfer, knowledge organization and storage, knowledge application, knowledge assessment, knowledge creation, information and knowledge security provision	PKM components
Knowledge search, application of experiences, effective interaction, computer skills, knowledge management skills, mastery of basic medical education knowledge, comprehensive knowledge assessment skills, teamwork skills, knowledge utilization skills, knowledge transfer skills	PKM skills
Cultural platform, educational platform, organizational platform, individualistic platform	PKM platforms
Personal egos, inadequate and inappropriate learning of pedagogical knowledge, empirical practice, imbalance between multiple teacher tasks, inappropriate knowledge organization and storage, and lack of optimal time management	Low maturity level in PNM
Attempts to gain credible knowledge, efforts to apply effective educational interventions, efforts to acquire the skills required for PKM, professional performance in education, attempts to change the educational process based on pedagogical knowledge, efforts for appropriate pedagogical knowledge transfer and support, attempts to appropriately register and organize pedagogical knowledge, pedagogical assessment aimed at enhancement, attempt to create pedagogical knowledge	Efforts to promote maturity in PKM
Cultural support, provision of educational equipment and facilities, educational support, systemic support	Professional support
Quality improvement and education development, promotion of student	PKM

satisfaction and learning, promotion of job satisfaction and professional  
development of the teachers, improvement of the quality of health care  
services

outcomes