

2020

Applying Markov Chain Analysis to Supervisory Interactions

Dan Li

University of North Texas, Dan.Li@unt.edu

David K. Duys

University of Iowa, david-duys@uiowa.edu

Darcy Haag Granello

The Ohio State University, granello.1@osu.edu

Follow this and additional works at: <https://repository.wcsu.edu/jcps>



Part of the [Counselor Education Commons](#)

Recommended Citation

Li, D., Duys, D. K., & Granello, D. H. (2020). Applying Markov Chain Analysis to Supervisory Interactions. *The Journal of Counselor Preparation and Supervision*, 13(1). <http://dx.doi.org/10.7729/131.1325>

Applying Markov Chain Analysis to Supervisory Interactions

Abstract

In this study, we explored transitional dynamics (i.e., movement patterns between six common supervision events) of the supervision process using transcripts of 20 actual supervision sessions in naturalistic settings. Specifically, we first proposed an events-based framework to conceptualize the supervision process. We then provided a step-by-step protocol to perform Markov chain analysis, which is an innovative and useful means to study ongoing processes. Next, we identified transitional dynamics of the entire sample and then detected statistically different verbal interactional patterns for the dyads with longer or shorter trainee experience. Results of this study provided insights on supervision process features for clinical supervisors and counselor educators.

Keywords

transitional dynamics, clinical supervision, Markov chain analysis, trainee experience

Clinical supervision plays a pivotal role in advancing the professional development of counselors across their professional lifespan, promoting the quality of counseling services provided by supervisees, and ensuring effective agency functioning (Borders et al., 2014). In order to disentangle the complexity of supervision, studies targeted various dimensions of supervision, including (a) supervisor and supervisee factors (e.g., gained experience, supervisory styles, and attachment styles); (b) supervision processes (e.g., supervisory relationship and working alliance); and (c) supervision outcomes (e.g., counseling students' satisfaction with supervision and counselor trainees' perceived self-efficacy), among others (Fernando & Hulse-Killacky, 2005; Gunn & Pistole, 2012; Ladany, Walker, & Melincoff, 2001; Li, Duys, & Granello, 2019; Worthington, 1987).

Supervision Process

Although the term *supervision process* is frequently referred to in the supervision literature, it has been loosely defined. For instance, it was understood as related to supervision practice and training in general, as well as related to the level of pedagogy specifically (Bernard & Luke, 2015). In Bernard and Luke's review of 184 counselor supervision articles from 2005-2014, the majority of supervision process articles addressed the *general processes* ($n = 18$; 85.7%), with the rest targeting *process of evaluation* ($n = 1$; 4.76%), *parallel process/isomorphism* ($n = 1$; 4.76%), and *wellness based* ($n = 1$; 4.76%). Supervision process was primarily discussed in conceptual articles, as opposed to in research (Bernard & Luke, 2015). However, this finding may be due to the exclusion of articles that examine working alliance, which are predominantly research-based (Bernard & Luke, 2015). An in-depth understanding of supervision process calls for a uniform definition with operationalized subcategories, if applicable. In this study, supervision process refers to the continuous verbal

interactions between the supervisor and supervisee in dyadic supervision; it is specific to each supervision session.

A plethora of research explores people's perceptions of the supervision process (e.g., working alliance), from the perspective of the supervisor (e.g., Ladany et al., 2001) or the supervisee (e.g., Crocket & Hays, 2015), with the actual verbal interactions between the supervisor and supervisee in naturalistic settings much less frequently addressed (e.g., Li et al., 2019). Results of these studies (e.g., Crocket & Hays, 2015; Ladany et al., 2001) support the overall finding that the resulting relationship manifests as an interdependent process, with both members of the dyad interacting to enhance the professional development of the supervisee. What is less clear, however, is how that interactional process works within the supervisory dyad, which is the topic of this study. This is because reliance on self-reports of what occurs during supervision may have limited implications for understanding the actual process of supervision, given that perceptions may not accurately reflect reality (Borders, 1989; Li, 2018, Unpublished doctoral dissertation; Li et al., 2019). Due to the transient nature of supervisory interactions, transcripts of recorded supervision sessions that occurred in regular supervision meetings can be an effective way of studying the actual supervision process, as opposed to the supervisor's or supervisee's retrospective narrative elaborations or quantitative ratings. However, these transcripts only rebuild the continuous verbal exchanges between the supervisor and supervisee, which entails a concrete framework with measurable units of analysis to conceptualize the supervision process.

Events-Based Framework to Conceptualize the Supervision Process

The basic unit of analysis to describe the supervision process can take many forms with varying lengths, which is driven by the intended research questions. For instance, Granello

(2003) used 21 revised Blumberg Interactional Analysis System (BIA) categories as the units of analysis to conceptualize the supervision process, and examined the influence strategies in supervision as related to gender and age. Li et al. (2019) used 16 remodified BIA categories (e.g., information-based questions or answers; opinion-oriented questions or answers; and social emotional behaviors) to analyze the supervision process, and detected a repetitive pattern between *opinions* and *social emotional behaviors* in dyads with more experienced supervisors or supervisees by using sequential analysis.

The structure and content of clinical supervision are subject to a multitude of factors. Despite the presence of substantial uncertainties and idiosyncrasies, a constellation of *events* frequently become the focus of the supervision process, such as the discussion of specific counseling theories and skills; the standards of service; case conceptualization; the change process; supervisees' personal issues that get in the way of the counseling process (Bordin, 1983); individual differences (e.g., racial, ethnic, cultural, or other differences); treatment goals and plans; assessment and intervention skills; and professional ethics (Stoltenberg & McNeill, 2010). Understanding the dynamics of how these common events unfold in supervision can deepen clinical supervisors' and counselor educators' comprehension of the supervision process, which is the focus of this study.

As the first step to explore these dynamics, we developed an events-based theoretical framework with operational definitions to conceptualize the supervision process. As discussed earlier, a series of common events are frequently observed in clinical supervision (e.g., Bordin, 1983; Stoltenberg & McNeill, 2010), regardless of the specific content of each supervision session. However, a simple juxtaposition of these events does not exhibit the progressively complex nature of these events in supervision. For instance, it is not uncommon for entry-level

supervisees to focus on the practice of newly learned counseling skills (e.g., Stoltenberg & McNeill, 2010), as opposed to supervisees at advanced training levels who are more intentional about developing their professional identity, such as “how what they do fits into who they are and how who they are dictates what they do” (Li, Liu, & Lee, 2018, p. 1141). Another example is that experienced counselors rarely adhere to a linear counseling plan, but they tend to organize their knowledge in a hierarchical fashion and develop functional rather than simply descriptive accounts of the targeted problem (Oddli, Halvorsen, & Rønnestad, 2014). In most developmental supervision models, clinical supervision is described as a process with qualitatively distinct stages that both supervisors and supervisees experience (e.g., Dunn, Callahan, Farnsworth, & Watkins, 2017; Littrell, Lee-Borden, & Lorenz, 1976; Stoltenberg & McNeill, 2010). The tendency that supervisees are task-oriented early on in their training and then become more aware of relational issues (e.g., with clients and with supervisors), which eventually lead to their autonomy in practice and intentionality in developing their integrated professional identity, serves as the foundation of this study to organize the common supervision events in a progressively complex manner.

Bordin (1983) proposed eight supervisory goals, which are mostly stated from the viewpoint of the person being supervised. These goals include (a) mastery of specific skills; (b) enlarging one’s understanding of clients; (c) enlarging one’s awareness of process issues; (d) increasing awareness of self and impact on process; (e) overcoming personal and intellectual obstacles toward learning and mastery; (f) deepening one’s understanding of concepts and theory; (g) provide a stimulus to research; and (h) maintenance of standards of service. These goals also signify distinct events that are frequently observed in any type of clinical supervision (e.g., clinical mental health counseling; marriage, couple, and family counseling; and school

counseling), and thus can be used to conceptualize the supervision process. We collapsed and modified these goals into six “events” of interest, which entail increasingly enhanced training and experience. Specifically, the six events include: (a) social interfacing; (b) reflecting on foundational competencies; (c) developing case conceptualization; (d) processing the relational management; (e) overcoming personal and multicultural obstacles; and (f) furthering professional development.

We then provided operational definitions of each event, which constituted the codebook for data input. The first event is *social interfacing* (e.g., the supervisor and supervisee greet each other before they transition to other events). Although Bordin (1983) did not include this as one of the supervisory goals, this event is critical in building a transition model for Markov chain analysis (see the Method section for building the initial state vector). The second event is *reflecting on foundational competencies*. Specifically, it contains the mastery of specific skills (e.g., counseling and consultation skills); deepening one’s understanding of concepts (e.g., the miracle question) and theories (e.g., Gestalt therapy); and maintenance of standards of service (e.g., the hours log) in Bordin’s goals. The third event targets *developing case conceptualization*. It is mostly about enlarging one’s understanding of clients and the client system “by broadening one’s observational perspective both in time and in channels of communication” (Bordin, 1983, p. 37). The fourth event refers to *processing the relational management*. It is to brainstorm counseling interventions, to enhance one’s awareness of process issues (i.e., expanding the units of process being observed), or to increase one’s awareness of self and impact on process (Bordin, 1983). The fifth event revolves around *overcoming personal and multicultural barriers toward learning and mastery*, such as addressing the countertransference issue. The last event centers on *furthering professional development*. This can include discussing potential research endeavors

(Bordin, 1983); making a commitment to lifelong learning; fostering the sense of professional community; and integrating personal and professional identity (Gibson, Dollarhide, & Moss, 2010).

With such a framework in place, any supervision session can be broken down into a series of distinct events and the transitions between them. These events and transitions can be coded and quantified for further investigations in a descriptive (e.g., the frequency or percentage of an event in a certain type of supervisory dyads) or inferential (e.g., the underlying movement patterns from one event to another) manner. Although there is a commonly held belief and expectation that the supervision process differs based on supervisee developmental levels, this claimed difference has not been adequately studied or validated by observational research in naturalistic settings. If there is limited developmental research demonstrating how counselors become more competent as they acquire accumulated training and experience, the extant models of counselors training and post-graduation continuing education need to be revisited and further enhanced (Hill, Spiegel, Hoffman, Kivlighan, & Gelso, 2017). In this study, supervision process features were compared based on the lengths of supervisees' work experience, which provided empirical support at the micro-level to the aforementioned common belief and expectation.

Statistical Analyses to Study Supervision Process Features

After the continuous supervision process is broken down into measurable units, it calls for applicable statistical methods to detect the underlying patterns, if any. As mentioned earlier, Li et al. (2019) used sequential analysis to capture the moment-to-moment behavioral transition patterns within supervisory dyads and identified the reciprocal dynamics in clinical supervision. For instance, compared to the group with less experienced supervisees, in the group with more experienced supervisees, supervisees were more likely to respond to supervisors' opinions with

positive social emotional behaviors, and these behaviors in turn were more likely to elicit supervisors' opinions, which generated a reciprocal cycle. However, sequential analysis in that study was limited to examining adjacent behaviors—how the presence of an *antecedent* behavior may increase or decrease the likelihood of a *subsequent* behavior, if any.

Markov chain analysis is a relatively macroanalytic level of evaluating sequences that goes beyond the one-step prediction (e.g., sequential analysis) and can be applied to modeling long-run probabilities of actors' and partners' behaviors over time (Knobloch-Fedders et al., 2014). It was used to examine interactional patterns among couples (Knobloch-Fedders et al., 2014) and to investigate the pattern of emotional mimicry in business interactions (Rueff-Lopes, Navarro, Caetano, & Silva, 2015). Specifically, Knobloch-Fedders et al. (2014) recruited 97 couples from an urban, university-affiliated outpatient mental health center to examine the temporal nature of couples' *demand*, *withdraw*, and *submit* behaviors. By using Markov chain analysis, they found that couples' conflict behaviors exhibited a high degree of stability, which signified interpersonal processes that were relatively enduring and self-perpetuating and thus called for clinicians' interventions.

Markov chain analysis provides a useful and powerful means to map out sequential influences in interpersonal and interactional processes (Kaplan, 2008; Li, 2018, Unpublished doctoral dissertation; Mazzi, 2011). It was used to detect generalizable differences of using basic counseling skills between more effective and less effective counselors-in-training (Duys & Headrick, 2004). Duys and Headrick recruited 30 participants from two sections of a basic counseling skills course. They found that more effective students were more likely to transition between more advanced skills (e.g., open questions, paraphrasing, reflecting feelings, and summarizing), whereas less effective students were more likely to transition between less

challenging skills (e.g., process errors, nonskills, attending statements, encouragers, and closed questions) in their simulated counseling sessions. And these patterns stayed consistent that were independent of the issues and concerns introduced by the mock clients. However, they only examined mock counselors' use of counseling skills, without taking into account clients' responses.

In this study, we redefined the supervision process, proposed an events-based framework to conceptualize the supervision process, and used Markov chain analysis to explore the overall verbal interactional patterns in clinical supervision and compare these patterns based on varying levels of trainee experience. Two research questions drive the design of this study: (a) what are the verbal interactional patterns as both members within the supervisory dyad transition between the six common events? and (b) are these interactional patterns different based on supervisees' lengths of training experience?

Method

Markov Chain Analysis

Lohnes (1965) described Markov chain analysis as “a methodological innovation” (p. 322) for human development research. The Markov chain model is a probability model that can be used to study an ongoing process (Lohnes, 1965). Specifically, this model can be used to examine the supervision process with measurable units by locating them in a temporal relationship (Hertel, 1972). Accordingly, this model enables researchers to compare and contrast interactional processes by analyzing transitions between events (Duys & Headrick, 2004). Each event of interest is termed as a *state* in Markov chain analysis. Furthermore, the identified transitional patterns provide “a theoretical model for, and a predictor of” (p. 109) the sequences of various states in clinical supervision. The Markov chain model thus not only describes the

likely immediate response of the supervisor or supervisee in the same dyad but predicts the eventual pattern as a result of the interaction sequence (Lichtenberg & Hummel, 1976).

Two assumptions undergird the Markov chain model: (a) the transition probabilities are stationary; namely, the probability of moving between any two states is not subject to their place in the series of transitions, which displays a stable pattern over time; and (b) each subsequent state is primarily dependent on the antecedent state as the process unfolds (Duys & Headrick, 2004; Kemeny & Snell, 1960; Lichtenberg & Hummel, 1976). A *transition* designates a move between any two consecutive states and *transition probabilities* refer to probability estimates of any given state being followed by any other state of interest (Lichtenberg & Hummel, 1976). Every supervision session is an ongoing process, which can be conceptualized by using the six-event framework. In the actual supervision, supervisory dyads may shift their focus from the current state to any other states in the codebook, and the following state is mainly related to the previous state rather than other states, which make the Markov chain model applicable to studying the supervision process. Accordingly, a continuous supervision process can be broken down into measurable, meaningful units, which can be coded, quantified, and located in a temporal relationship; namely, any supervision session can be represented by a series of numbers that designate the pre-defined states and the transitions between these states.

Specifically, transition probabilities can be calculated by dividing the frequency of a specified state-state transition by the total frequency its antecedent state (the first state in the transition) occurs as the antecedent of any transition in the sequence (Lichtenberg & Hummel, 1976). For instance, in order to obtain the estimated probability of *deepening case conceptualization* (state 3) being followed by *processing the relational management* (state 4), we divide the frequency of state 3 to state 4 transition ($f = 13$) by the total frequency the state 3

appears as the antecedent of any transition ($f = 21$) and the result is $13/21 = .6190$ (rounded to 4 decimal places). These probabilities are referred to as *first-order transitions* (Duys & Headrick, 2004) and can be compiled into a *transition matrix* \mathbf{P} , with columns (i) = antecedents and rows (j) = consequents (Lichtenberg & Hummel, 1976). Notably, probabilities in each column add up to 1, because the six designated states are exhaustive of the supervision process (Duys & Headrick, 2004). Any captured moment of supervision can be categorized into one of the six states.

The transition matrix \mathbf{P} provides explicit information concerning the likely immediate state (consequent) of the supervisory dyad based on the currently observed state (antecedent). In order to predict the eventual probability of each state that the supervisory dyad tends to occupy over time, the initial state vector \mathbf{x} needs to be defined and incorporated. The supervisory dynamics often start from the social interfacing (state 1) to one of the other five states. For example, it is not uncommon for the supervisory dyad to begin a session with greeting each other (e.g., “How are you doing today?”). In other words, the initial state for the supervisory dyad is state 1, with a probability of 1. This initial state plays a crucial role in defining the initial state vector \mathbf{x} , which has only one column and has the same length as the number of rows in the transition matrix \mathbf{P} (Duys & Headrick, 2004). The first entry of the initial state vector \mathbf{x} is 1, thereby leaving all other entries with 0 so that the sum of the probabilities in this column is 1 as is in the transition matrix \mathbf{P} .

The transition matrix \mathbf{P} and the initial state vector \mathbf{x} are jointly employed to define \mathbf{q} , the *steady-state vector* (Duys & Headrick, 2004), which displays the probabilities that the supervisory dyad will work on in each of the designated six states over time (t). The steady state signals a point at which increasing the length of supervision has no impact on the probabilities in

\mathbf{q} and the number of time periods (t) is determined *a priori* (Duys & Headrick, 2004). The time periods in this study are 50 ($t = 50$). The functional relationship between them is $\mathbf{P}^t \times \mathbf{x} = \mathbf{q}$ (Duys & Headrick, 2004). Specifically, the steady-state vector \mathbf{q} can be acquired by following two steps: (a) raising the transition matrix \mathbf{P} to the power of time periods (t) using the matrix multiplication rule; and (b) multiplying the resulting matrix from the first step by the initial state vector \mathbf{x} .

Participants

The dataset of this study includes verbatim transcripts of 20 dyadic supervision sessions, which is part of a national research project. In the original study, the collection of supervision recordings spanned over 9 months from counseling students across 19 institutions. Counseling faculty were contacted through the CESNET-L listserv, professional workshops on supervision, and telephone calls to 25 randomly selected counselor education programs. Granello's (2003) article provides detailed information about the sampling procedure. Each transcript captured 20-minute long verbal interactions between the supervisor and supervisee in naturalistic settings. All supervisors and supervisees are different individuals. Thus, the total number of participants is 40. All supervisors are on-site supervisors, as opposed to university faculty supervisors. Table 1 below includes specific demographic information of the 20 supervisory dyads.

Table 1

Demographic Information of the 20 Supervisory Dyads (N = 20)

Variable (Supervisor)	<i>n</i> (%)	Variable (Supervisee)	<i>n</i> (%)
Gender		Gender	
Female	13(65)	Female	10(50)
Male	7(35)	Male	10(50)
Race/Ethnicity		Race/Ethnicity	
Caucasian	17(85)	Caucasian	14(70)
African American	2(10)	African American	5(25)
Asian American	1(5)	Asian American	1(5)
Supervision Experience (months)		Work Experience (months)	
0-12	4(20)	0-8	9(45)
13-24	1(5)	9-16	9(45)
25-36	2(10)	17-24	1(5)
37-48	3(15)	25-30	1(5)
> 48	10(50)	Age Range	
Age Range		20-29	10(50)
20-29	1(5)	30-39	6(30)
30-39	5(25)	40-49	3(15)
40-49	9(45)	50-59	1(5)
50-59	3(15)	Training Level	
60-69	1(5)	Master's practicum	2(10)
Unreported	1(5)	Master's internship	15(75)
Professional Identity		Post-master's training	3(15)
Counsellors	12(60)	Theoretical Orientation	
Psychologists	6(30)	Psychodynamic	1(5)
Social workers	2(10)	Behavioral	1(5)
Theoretical Orientation		Person-centered	2(10)
Psychodynamic	3(15)	Cognitive	3(15)
Behavioral	1(5)	Eclectic	13(65)
Person-centered	6(30)		
Cognitive	3(15)		
Eclectic	7(35)		

Note. Supervisors' mean age was 44 years (range = 29 to 65, *SD* = 8.3). Supervisees' mean age was 32 years (range = 23 to 50; *SD* = 8.3) and their mean trainee experience was 9 months (range = 0 to 25 months, *SD* = 5.7).

Procedure

The first author coded the 20-minute long transcript of each recording, which was transformed into the frequency counts for data analysis. A transition frequency table was created for each supervisory dyad. A total of 210 transitions were observed from all the supervisory

dyads in this study. The unit of coding was based on supervisor-and-supervisee verbal interactions. The length of each coding unit varied, from one round of turn-taking to multiple rounds of turn-taking. Please see below for a modified coding example:

Supervisor: We're ignoring one thing. We're ignoring his belief about himself.

Supervisee: Uh huh.

Supervisor: Okay, so how do we get him to change that belief so the behavior can change?

Supervisee: We give him...I don't know, would we present situations where he is in control?

Supervisor: Give me an example.

Supervisee: Well, one thing that I've actually I've done is...

The entire segment of verbal interactions in this example was coded as a "4," because the supervisor enhanced the supervisee's awareness of process issues (e.g., the client's ignored belief about himself that may be critical to the change process) and the supervisory dyad worked collaboratively on brainstorming specific counseling interventions.

Data Analysis

Table 2 and Table 3 exhibit transitions between the *ij*-th state and resulting transition matrices for supervisees with work experience fewer than or equal to 8 months ($N = 9$) and supervisees with work experience more than or equal to 9 months ($N = 11$), respectively. Using these month lengths as cutting scores was an attempt to divide the sample into two groups that have similar number of participants. Meanwhile, according to the 2016 CACREP (Council for Accreditation of Counseling and Related Educational Programs) Standards, entry-level students complete a minimum of 100 clock hours practicum over a full academic term and 600 clock

hours of internship. Therefore, counselors-in-training who indicated 8 months work experience or less may be at the beginning or in the middle of their internship (Li et al., 2019), who are still early on in their professional training.

Table 2

Frequency of Transition Movements for Supervisory Dyads with Trainee Experience ≤ 8 Months (N = 9)

	State 1	State 2	State 3	State 4	State 5	State 6
State 1	0	0	0	0	0	0
State 2	2	0	5	11	1	0
State 3	6	5	0	8	4	0
State 4	0	10	13	0	2	0
State 5	1	1	3	5	0	0
State 6	0	0	0	0	0	0

Resulting Transition Matrix (Probabilities)

.0000	.0000	.0000	.0000	.0000	.0000	⁵⁰	1	.0000
.2222	.0000	.2380	.4583	.1429	.0000		0	.2459
.6667	.3125	.0000	.3333	.5714	.0000	×	0	= .2690
.0000	.6250	.6190	.0000	.2857	.0000		0	.3569
.1111	.0625	.1430	.2083	.0000	.0000		0	.1282
.0000	.0000	.0000	.0000	.0000	.0000		0	.0000

Note. The superscript “⁵⁰” designates that the matrix was raised to the 50th power.

Table 3

Frequency of Transition Movements for Supervisory Dyads with Trainee Experience ≥ 9 Months (N = 11)

	State 1	State 2	State 3	State 4	State 5	State 6
State 1	0	0	0	0	0	0
State 2	2	0	3	9	1	0
State 3	4	6	0	33	2	1
State 4	3	4	39	0	9	0
State 5	2	4	1	8	0	0
State 6	0	0	0	0	2	0

Resulting Transition Matrix (Probabilities)

.0000	.0000	.0000	.0000	.0000	.0000	⁵⁰	1	.0000
.1818	.0000	.0698	.1800	.0714	.0000		0	.1075
.3636	.4286	.0000	.6600	.1429	1.0000	×	0	= .3527
.2727	.2857	.9070	.0000	.6429	.0000		0	.4187
.1818	.2857	.0232	.1600	.0000	.0000		0	.1059
.0000	.0000	.0000	.0000	.1429	.0000		0	.0151

Note. The superscript “⁵⁰” designates that the matrix was raised to the 50th power.

Two collective matrices were built by using the events-based framework, with one for supervisory dyads where trainee experience was fewer than or equal to 8 months and the other with trainee experience greater than or equal to 9 months. The initial state vector \mathbf{x} was the same for both groups, with the first entry as 1 and the rest 0. We then entered the probabilities based on the frequencies of the state-to-state transitions. The Matlab R2014a (The Mathworks, Natick, MA) was used to perform the computation based on the aforementioned functional relationship between \mathbf{P}^t , \mathbf{x} , and \mathbf{q} . The steady-state vector \mathbf{q} for each group eventually became available. Notably, when interpreting the probabilities in both transition matrices (Table 2 and Table 3), they can be compared to probabilities in the same column, but not probabilities across the column. This is because the probability in each cell is calculated based on the total frequency in the column where it belongs. Therefore, the value of $p_{63} = 1$ (the probability of transition from state 6 to state 3 in Table 3) should not be surprising given the zero frequency in other cells in the same column. The transition movements frequency table above each transition matrix provides helpful guidance for probability interpretations.

Results

Prior to exploring supervisory transition patterns of the two groups, respectively, the entire sample was examined collectively, which addressed the first research question. The resulting transition matrix indicated that all supervisory dyads were much more likely to work on

case conceptualization (state 3) and relational management (state 4) than all other states. This finding was mostly aligned with the independent examination of the two groups. However, supervisory dyads with less trainee experience tended to also focus on an additional state (24.59%), namely, reflecting on foundational competencies (state 2), when separately examined. This state was not highlighted as much as it was in supervisory dyads with more trainee experience (10.75%).

Specifically, for the group with less trainee experience, the probabilities of these supervisory dyads to occupy the six states over time are .0000, .2459, .2690, .3569, .1282, and .0000, respectively. State 1 is social interfacing that works as a springboard for supervisory dyads to launch other supervision tasks. As a result, the probability of 0 explains the unlikelihood of the dyads to stay in state 1 in the long run. The probability for supervisory dyads to stay in state 4 was the highest. For the group with more trainee experience, the probabilities that their supervision sessions tend to occupy are .0000, .1075, .3527, .4187, .1059, and .0151, respectively. State 3 and 4 exhibited much higher tendencies for supervisory dyads to remain. That is, supervisory dyads with more trainee experience have the probability of 77.14% to stay in either state 3 or 4, compared to 62.59% for the dyads with less trainee experience. Figure 1 displayed the two chains.

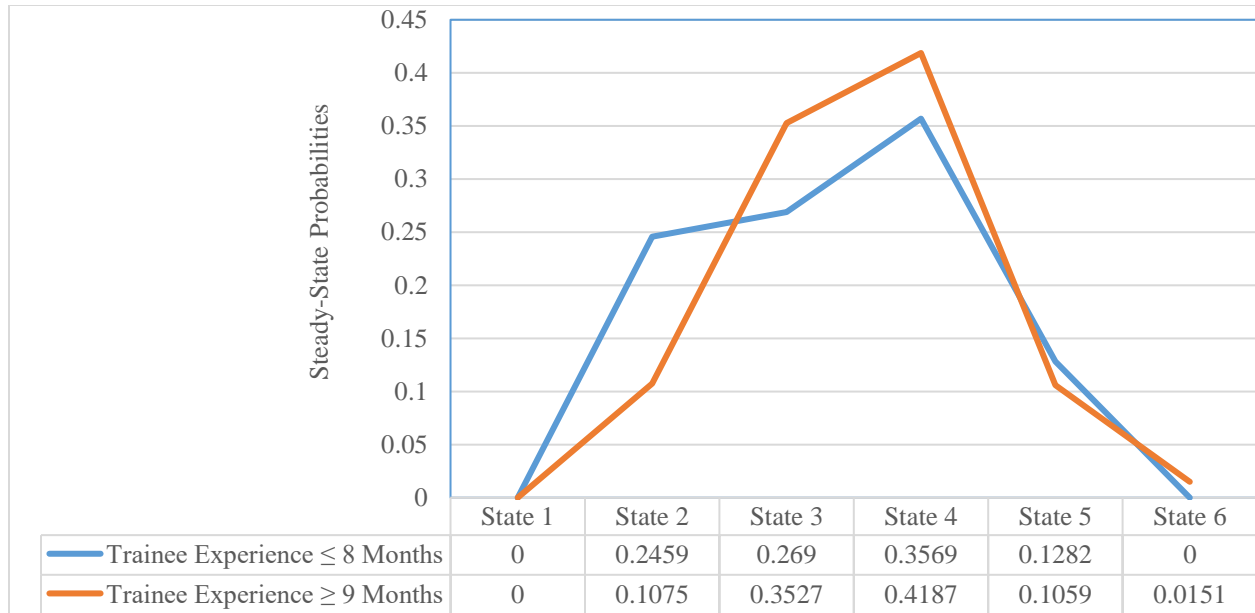


Figure 1. Steady-state probabilities for the two groups using Markov chain analysis.

To probe into the micro-level transition distributions of the two groups, we conducted chi-square analyses based on transition frequency counts (see Table 4). Due to the limitation of sparse matrices, the data were collapsed into two 2×2 contingency tables. The six supervision states are progressively complex. As a result, the first three states and the last three were independently collapsed. The events E_1 and E_2 indicate that supervisory dyads are in state 1, state 2, or state 3. The events \bar{E}_1 and \bar{E}_2 indicate that supervisory dyads are in state 4, state 5, or state 6. The upper left cell in each contingency table listed the total frequency of the consequent events E_1 when supervisory dyads were in state 1, 2, or 3, given their antecedent events E_2 in state 1, 2, or 3. Likewise, the lower right cell in each contingency table presented the total frequency of the consequent events \bar{E}_1 when supervisory dyads were in state 4, 5, or 6, given their antecedent events \bar{E}_2 in state 4, 5, or 6.

Table 4

Contingency Table Analyses for the Test of Homogeneity of Odds Ratios (OR)

Trainee Experience \leq 8 months				Trainee Experience \geq 9 months			
Event	E_2	\bar{E}_2	Total	Event	E_2	\bar{E}_2	Total
E_1	18	24	42	E_1	15	46	61
\bar{E}_1	28	7	35	\bar{E}_1	53	19	72
Total	46	31	77	Total	68	65	133
$OR (2 \times 2): 0.1875 = (18 \times 7)/(24 \times 28)$				$OR (2 \times 2): 0.1169 = (15 \times 19)/(46 \times 53)$			
$\chi^2_{(df=1)} = 10.95, p < .001$				$\chi^2_{(df=1)} = 31.76, p < .0001$			
$OR (2 \times 2 \times 2): 1.6039 = 0.1875/0.1169$							
$\chi^2_{(df=1)} = 37.20, p < .00001$							

Note. The events E_1 and E_2 indicate that supervisory dyads are in state 1, state 2, or state 3. The events \bar{E}_1 and \bar{E}_2 indicate that supervisory dyads are in state 4, state 5, or state 6.

The Pearson chi-square analysis of both contingency tables exhibited statistically significant odds ratios (OR ; $\chi^2_{(df=1)} = 10.95, p < .001$ for the group with less trainee experience; and $\chi^2_{(df=1)} = 31.76, p < .0001$ for the other group). The supervisory dyads in both groups were less likely to stay in the first three states ($OR = 0.1875$ for the group with less trainee experience and $OR = 0.1169$ for the other group). Running a $2 \times 2 \times 2$ analysis to test the homogeneity of the odds ratio generated a significant chi-square statistic ($\chi^2_{(df=1)} = 37.20, p < .00001$). In other words, supervisory dyads with more trainee experience were approximately 1.6 times more likely than the other group to stay in state 4, 5, or 6.

Discussion

This is an exploratory study of the verbal interactional patterns between supervisors and supervisees using Markov chain analysis that is infrequently used to study clinical supervision. This analysis provides a unique and innovative perspective (Duys & Headrick, 2004; Lohnes, 1965) to examine the transitional dynamics of supervision between six common events, which can enrich the supervision and counseling literature. Importantly, this analysis can uncover the dynamics that actually occur within the supervisory dyads during supervision, as Knobloch-

Fedders et al. (2014) did in their study to examine couples' interactional dynamics, rather than relying on participants' self-reported perceptions. Supervision dynamics can be described as its constituent parts and how these parts relate to each other. This study specifically delineated the primary supervision events (states), exhibited the likelihood of one state (antecedent) being followed by another (subsequent), predicted the probabilities of the states that a supervisory dyad tends to occupy in the long term, and how these findings varied based on the length of trainee experience.

Despite the congruence of both groups' tendencies to work on case conceptualization (state 3) and relational management (state 4), dyads with less trainee experience also tended to address foundational competencies in supervision sessions. This finding echoes the existing literature that new counselors-in-training tend to focus on their individual skills as one important means to define their work and professional identity (Gibson et al., 2010). This salient self-focus in beginning counseling students mainly derives from their anxiety, low self-efficacy, and fear of incompetence given the multitude of professional competencies to develop (Stoltenberg, 2005; Stoltenberg & McNeill, 2010). As supervisees' counseling skillset advances with accumulated training and experience, they then shift their excessive self-focus to clients and their worlds, both cognitively and affectively (Stoltenberg, 2005; Stoltenberg & McNeill, 2010). This allows supervisees to process the case conceptualization of clients as well as counseling dynamics that unfold over time.

The six supervision states are progressively complex from the first to the last, thereby entailing increasingly complex cognitive and affective endeavors. The Markov chain model and chi-square analyses both demonstrated that supervisory dyads with more trainee experience tended to occupy the states that lean toward one end of the state-spectrum, namely, the states that

call for more cognitive and affective complexity. Specific to the state of overcoming personal and multicultural barriers (state 5), however, the steady-state probability for supervisory dyads with less trainee experience was slightly higher (12.82%) than that of the more experienced group (10.59%). This finding was inconsistent with the literature that advanced supervisees were more inclined to address personal issues or defensiveness that impacted their counseling, compared to their beginning counterparts (Heppner & Roehlke, 1984). This could possibly be a result of the small sample size. Alternatively, less experienced supervisees may have a higher need to process the barriers that distract them from achieving the expected professional and personal standards, as seen in elevated occurrences of cultural discussions when international supervisees exhibited a lower level of acculturation (Nilsson & Dodds, 2006).

As for the last state of furthering professional development (state 6), the Markov chain model suggested that supervisory dyads with less trainee experience tended to not stay in this state in the long term, whereas the likelihood for the more experienced group to occupy this state was 1.51%. This finding was consistent with most developmental supervision models and research studies that supervisees progress to this state as they acquire augmented knowledge, skills, and attitudes (Gibson et al., 2010; Stoltenberg, 2005; Stoltenberg & McNeill, 2010). However, this less pronounced difference needs to be interpreted with extra precaution because it can be similarly attributable to the small sample size.

The present study provided empirical support at the micro-level to the overall finding in the existing literature that the supervision process is an interdependent process, with both members of the dyad interacting to enhance the professional advancement of the supervisee (e.g., Crocket & Hays, 2015; Ladany et al., 2001). It is also echoed by Li et al.'s (2019) findings that supervisory dyads exhibit different interactional patterns based on the experience level of

supervisees. Similar to Duys and Headrick's (2004) identification of statistically significant differences in two groups' (i.e., effective and ineffective) transitions between basic counseling skills by using Markov chain analysis, we detected distinct transition patterns for groups with longer or shorter trainee experiences, independent of the issues and concerns that arose in supervision. This signifies the applicability of Markov chain analysis to studying the supervision process.

Implications for Clinical Supervision and Counselor Education

Although research endeavors have been invested in studying issues that supervisors or supervisees bring to or arise in the process of supervision (DePue, Lambie, Liu, & Gonzalez, 2016; Fernando & Hulse-Killacky, 2005; Gunn & Pistole, 2012; Ladany et al., 2001), an agreed-upon definition of supervision process, the principal, functional parts of supervision process, and the flow between them have rarely been examined (Li et al., 2019). In this study, supervision process is defined as the continuous verbal interactions between the supervisor and supervisee. Our proposed events-based framework will allow clinical supervisors to conceptualize any supervision session with identifiable states, thereby benefiting their planning of forthcoming supervision meetings and their reflections on sessions that occurred in the past. In addition, different verbal interactional patterns identified in this study can prepare clinical supervisors with anticipated supervisee performances based on their training levels. Centering around supervisees' developmental growths and their unique needs, supervisors can construct a flexible supervisory environment that allows for appropriate movements between the six supervision states.

For beginning supervisees who may feel overwhelmed by the unfamiliar supervision context, the supervisor needs to reserve ample room for state 2 (reflecting on foundational

competencies) during initial supervision sessions before proceeding to the following states. Specifically, the supervisor can broach a discussion on supervisory expectations, the maintenance of service standards, and evaluation practices (Bernard & Goodyear, 2014; Stoltenberg & McNeill, 2010). If supervisees are ready to further their professional development (state 6), the supervisor can guide supervisees to think through their professional identities (Gibson et al., 2010), how their professional and personal identities manifest themselves, and how the interdependence and interaction between these identities may independently and collectively exert influence on supervisees' counseling practices (Rønnestad & Skovholt, 2001), among others.

The six supervision states and transitions between them not only can be used to conceptualize the dynamics of supervisory dyads but can be modified and employed as a framework to visualize group or classroom dynamics in counselor education. It is common for counselor educators to develop planned components prior to teaching, however structured or unstructured their plans might be (e.g., a written teaching protocol or a conceptually conceived activity). The flow of the class, nevertheless, is subject to a broad array of factors, and thus may not go exactly as expected. The six states can provide counselor educators a conceptual map of events that may occur in class. This conceptualization benefits counselor educators in at least two ways: (a) enriching educators' knowing-in-action (KIA; a process by which people's actions indicate what they know) so that it is readily applicable in future similar situations; and (b) improving educators' reflection-in-action (RIA; a process of reflecting on failed actions in the here and now) to address unanticipated reactions or outcomes that would have been attended to through reflection-on-action (ROA; a process of reflecting back on performed tasks at a later time) (Schön, 1987; Stoltenberg & McNeill, 2010). Given the enhanced KIA and RIA, counselor

educators can make a better judgment call about the timing and types of interventions to offer (e.g., practicing specific counseling skills or enlarging counseling students' awareness of process issues).

In this study, both the Markov chain analysis and chi-square analyses exhibited different transition patterns of supervisory dyads with varying trainee experiences. This corroborated an underlying belief that counselor education programs have been upholding; that is, clinical training and experience are integral to the advancement of counseling students' professional and personal growth, on both master's and doctoral levels. As such, they become critical criteria in determining a professional's competence, credentials, and licensures (Hill et al., 2017). In Rønnestad and Skovholt's (2001) qualitative inquiry, the senior psychotherapists particularly highlighted the profound influence of their extensive professional experience on their professional work. Moreover, they reported that their personal experience also produced far-reaching impacts on them professionally. Given the crucial role of experience in mental health professions, counselor educators and clinical supervisors should respect students' professional and personal experiences, and intentionally design classes and assignments in a manner that can bridge students' training and experience.

Limitations and Implications for Future Research

This is a pilot study with a relatively small number of 40 participants (20 supervisory dyads). But a total of 210 transition frequencies between six states were observed and served as the initial data input, instead of the 40 participants. In Duys and Headrick's (2004) Markov chain study of the counseling process, they recruited 30 participants, with each participant playing a counselor's role in one session and a client's role in another, which may limit the variability of mock counselors' demonstration of counseling skills. In addition, they only transcribed five

minutes of each simulated counseling session for the initial data input. In our study, all participants were different individuals and we analyzed 20 minutes of each supervision session, which allowed for an expanded capture of the supervision process.

It is worth noting that the number of participants is not the only parameter that determines the frequency of the transition matrix. Researchers may consider increasing the length of supervision recordings to transcribe. Due to the limited number of transitions between certain states in this study, we collapsed the first three states (cluster 1) and the last three (cluster 2), respectively. Although the chi-square analyses yielded statistically significant results, they were presented in broad clusters of states. Fortunately, the Markov chain analysis can generate the steady-state probabilities of the six states, thereby furthering and complementing the results derived from chi-square analyses.

Despite all our efforts, this sample size may still limit the generalizability of our findings to the larger population. However, this study signifies an exploratory initiative to apply Markov chain analysis, an innovative and useful means, to detecting the underlying interactional patterns between supervisors and supervisees in the actual supervision sessions. Given a larger sample of participants, researchers will have more freedom to examine a wider range of variables, based on which supervisory transition patterns may differ, such as gender, age, theoretical orientation, and supervision style that have been found to be critical in clinical supervision (Goodyear, Abadie, & Efros, 1984; Granello, 2003; Li, 2018, Unpublished doctoral dissertation). In addition, researchers will have more flexibility in deciding the cutoff scores for group comparisons.

Finally, supervisory dyads did not spend equal amounts of time on each state, which can be easily detected by the varying lengths of each state in transcripts. For future studies, researchers may consider including the time length dimension so that the Markov chain model

can provide more accurate predictions. Researchers may use a predetermined time segment (e.g., every five minutes) or a fixed number of transcript pages to set the length of each coding unit. Notably, it will then be likely to observe some self-to-self transitions. For instance, a supervisory dyad may work on case conceptualization for 10 minutes. If the fixed length of the coding unit is five minutes, then this segment will be coded as a transition from state 3 to state 3.

Conclusion

In this study, we explored verbal interactional patterns of 20 supervisory dyads between six common supervision events using Markov chain analysis. In general, supervisory dyads tended to work on case conceptualization and relational management, compared to other supervision tasks. Despite this common finding, different transition movement patterns emerged when trainee experience was taken into consideration. For instance, supervisory dyads with less trainee experience were more likely to address foundational competencies, whereas discussions regarding furthering professional development were more likely to occur in the group with more trainee experience. These patterns are consistent with the existing literature that supervisees focus on progressively complex issues in clinical supervision as they accumulate experience. These findings provide clinical supervisors and counselor educators insights on the identification of specific states that supervisees or students are located, how to select and construct the next state that may better facilitate growth, and how to guide supervisees or students in channeling their experience and counselor training.

References

- Bernard, J. M., & Goodyear, R. K. (2014). *Fundamentals of clinical supervision* (5th ed.). Upper Saddle River, NJ: Pearson Education.
- Bernard, J. M., & Luke, M. (2015). A content analysis of 10 years of clinical supervision articles in counseling. *Counselor Education and Supervision, 54*, 242-257. doi: 10.1002/ceas.12024
- Borders, L. D. (1989). A pragmatic agenda for developmental supervision research. *Counselor Education and Supervision, 29*, 16-24. doi: 10.1002/j.1556-6978.1989.tb01130.x
- Borders, L. D., Glossoff, H. L., Welfare, L. E., Hays, D. G., DeKruyf, L., Fernando, D. M., & Page, B. (2014). Best practices in clinical supervision: Evolution of a counseling specialty. *The Clinical Supervisor, 33*, 26-44. doi: 10.1080/07325223.2014.905225
- Bordin, E. S. (1983). A working alliance based model of supervision. *The Counseling Psychologist, 11*, 35-42. doi: 10.1177/0011000083111007
- Council for Accreditation of Counselling and Related Educational Programs. (2016). *2016 CACREP standards*. Retrieved from <http://www.cacrep.org/wp-content/uploads/2018/05/2016-Standards-with-Glossary-5.3.2018.pdf>
- Crockett, S., & Hays, D. G. (2015). The influence of supervisor multicultural competence on the supervisory working alliance, supervisee counseling self-efficacy, and supervisee satisfaction with supervision: A mediation model. *Counselor Education and Supervision, 54*, 258-273. doi: 10.1002/ceas.12025
- DePue, M. K., Lambie, G. W., Liu, R., & Gonzalez, J. (2016). Investigating supervisory relationships and therapeutic alliances using structural equation modeling. *Counselor Education and Supervision, 55*, 263-277. doi: 10.1002/ceas.12053
- Dunn, R., Callahan, J. L., Farnsworth, J. K., & Watkins, C. E., Jr. (2017). A proposed framework for addressing supervisee-supervisor value conflict. *The Clinical Supervisor, 36*, 203-222. doi: 10.1080/07325223.2016.1246395
- Duys, D. K., & Headrick, T. C. (2004). Using Markov chain analyses in counselor education research. *Counselor Education and Supervision, 44*, 108-120. doi: 10.1002/j.1556-6978.2004.tb01864.x
- Fernando, D. M., & Hulse-Killacky, D. (2005). The relationship of supervisory styles to satisfaction with supervision and the perceived self-efficacy of master's-level counseling students. *Counselor Education and Supervision, 44*, 293-304. doi: 10.1002/j.1556-6978.2005.tb01757.x
- Gibson, D. M., Dollarhide, C. T., & Moss, J. M. (2010). Professional identity development: A grounded theory of transformational tasks of new counselors. *Counselor Education and Supervision, 50*, 21-38. doi: 10.1002/j.1556-6978.2010.tb00106.x
- Goodyear, R. K., Abadie, P. D., & Efros, F. (1984). Supervisory theory into practice: Differential perception of supervision by Ekstein, Ellis, Polster, and Rogers. *Journal of Counseling Psychology, 31*, 228-237. doi: 10.1037/0022-0167.31.2.228
- Granello, D. H. (2003). Influence strategies in the supervisory dyad: An investigation into the effects of gender and age. *Counselor Education and Supervision, 42*, 189-202. doi: 10.1002/j.1556-6978.2003.tb01811.x
- Gunn, J. E., & Pistole, M. C. (2012). Trainee supervisor attachment: Explaining the alliance and disclosure in supervision. *Training and Education in Professional Psychology, 6*, 229-237. doi: 10.1037/a0030805

- Heppner, P. P., & Roehlke, H. J. (1984). Differences among supervisees at different levels of training: Implications for a developmental model of supervision. *Journal of Counseling Psychology, 31*, 76-90. doi: 10.1037/0022-0167.31.1.76
- Hertel, R. K. (1972). Application of stochastic process analyses to the study of psychotherapeutic processes. *Psychological Bulletin, 77*, 421-430. doi: 10.1037/h0032719
- Hill, C. E., Spiegel, S. B., Hoffman, M. A., Kivlighan Jr., D. M., & Gelso, C. J. (2017). Therapist expertise in psychotherapy revisited. *The Counseling Psychologist, 45*, 7-53. doi: 10.1177/0011000016641192
- Kaplan, D. (2008). An overview of Markov chain methods for the study of stage-sequential developmental processes. *Developmental Psychology, 44*, 457-467. doi: 10.1037/0012-1649.44.2.457
- Kemeny, J. G., & Snell, J. L. (1960). *Finite Markov chains*. Princeton, NJ: D. Van Nostrand Company, INC.
- Knobloch-Fedders, L. M., Critchfield, K. L., Boisson, T., Woods, N., Bitman, R., & Durbin, C. E. (2014). Depression, relationship quality, and couples' demand/withdraw and demand/submit sequential interactions. *Journal of Counseling Psychology, 61*, 264-279. doi: 10.1037/a0035241
- Ladany, N., Walker, J. A., & Melincoff, D. S. (2001). Supervisory style: Its relation to the supervisory working alliance and supervisor self-disclosure. *Counselor Education and Supervision, 40*, 263-275. doi: 10.1002/j.1556-6978.2001.tb01259.x
- Li., D. (2018). *Transitional dynamics of clinical supervision: Using Markov chain analysis* (Unpublished doctoral dissertation). University of Iowa, Iowa City.
- Li, D., Duys, D. K., & Granello, D. H. (2019). Interactional patterns of clinical supervision: using sequential analysis. *Asia Pacific Journal of Counselling and Psychotherapy, 10*(1), 70-92. doi:10.1080/21507686.2018.1553791
- Li, D., Liu, Y., & Lee, I. (2018). Supervising Asian international counseling students: Using the integrative developmental model. *Journal of International Students, 8*, 1129-1151. doi: 10.5281/zenodo.1250415
- Lichtenberg, J. W., & Hummel, T. J. (1976). Counseling as stochastic process: Fitting a Markov chain model to initial counseling interviews. *Journal of Counseling Psychology, 23*, 310-315. doi: 10.1037/0022-0167.23.4.310
- Littrell, J. M., Lee-Borden, N., & Lorenz, J. (1976). A developmental framework for counseling supervision. *Counselor Education and Supervision, 19*, 129-136. doi: 10.1002/j.1556-6978.1976.tb02021.x
- Lohnes, P. R. (1965). Markov models for human development research. *Journal of Counseling Psychology, 12*, 322-327. doi: 10.1037/h0022582
- Mazzi, M. A. (2011). Quantitative methods for the analysis of verbal interactions in psychotherapy. In M. Rimondini (Eds.), *Communication in cognitive behavioral therapy* (pp. 233-247). New York, NC: Springer.
- Nilsson, J. E., & Dodds, A. K. (2006). A pilot phase in the development of the international student supervision scale. *Journal of Multicultural Counseling and Development, 34*, 50-62. doi: 10.1002/j.2161-1912.2006.tb00026.x
- Oddli, H. W., Halvorsen, M. S., & Rønnestad, M. H. (2014, October). *Expertise demonstrated: What does it mean to be an expert psychotherapist?* Retrieved from: <http://societyforpsychotherapy.org/expertise-demonstrated>

- Rønnestad, M. H., & Skovholt, T. M. (2001). Learning arenas for professional development: Retrospective accounts of senior psychotherapists. *Professional Psychology: Research and Practice, 32*, 181-187. doi: 10.1037/0735-7028.32.2.181
- Rueff-Lopes, R., Navarro, J., Caetano, A., & Silva, A. J. (2015). A Markov chain analysis of emotional exchange in voice-to-voice communication: Testing for the mimicry hypothesis of emotional contagion. *Human Communication Research, 41*, 412-434. doi: 10.1111/hcre.12051
- Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco, CA: Jossey-Bass.
- Stoltenberg, C. D. (2005). Enhancing professional competence through developmental approaches to supervision. *American Psychologist, 60*, 857-864. doi: 10.1037/0003-066X.60.8.85
- Stoltenberg, C. D., & McNeill, B. W. (2010). *IDM supervision: An integrative developmental model for supervising counselors and therapists* (3rd ed.). New York, NY: Routledge.
- Worthington, E. L. (1987). Changes in supervision as counselors and supervisors gain experience: A review. *Professional Psychology: Research and Practice, 18*, 189-208. doi: 10.1037/0735-7028.18.3.189