From Their Eyes: What Constitutes Effective Formative Written Feedback for Neurosurgery Residents

By

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Finally, I would like to acknowledge my wife Katee and daughter Clara. Without their support, none of this would be possible.

Dedication

I would like to dedicate this work to the residents and staff in the National Capital Consortium Neurosurgery Residency Program. May we continually strive to be better.

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Abstract

Title: From Their Eyes: What Constitutes Effective Formative Written Feedback for Neurosurgery Residents

Background: The characteristics of quality feedback from the neurosurgery resident's perspective are not fully elucidated. The Surgical Autonomy Program (SAP) is an intra-operative assessment tool based on Vygotsky's Zone of Proximal Development (ZPD). SAP facilitates assessment of a resident's operative performance accompanied by written feedback.

Objective: The goal of this study was twofold: identify themes within written feedback from the operating room and examine if these themes influenced the neurosurgery residents' perception of feedback quality.

Methods: In 2021, SAP data from 2019-2021 at two neurosurgery programs were reviewed. Feedback quality from the SAP was determined by the resident at the time of their assessment. Using a constant comparative technique, the feedback was coded using a thematic analysis. The quality of feedback within each code was analyzed.

Results: There were 2968 SAP entries evaluated. When the ZPD concept was fully used, residents reported high quality feedback 91.4% of the time compared to 58.6% when ZPD was not used ($p<0.001$). Qualitative analysis of the written feedback revealed 5 themes: Non-Specific, Specific General Observations, Key Points, Next Steps, and Independent Practice. Feedback in the Specific General Observations, Key Points, and Independent Practice categories were associated with higher level feedback than leaving the space blank ($p<0.001$) or writing Non-Specific comments ($p<0.001$).

Conclusions: Providing comments that discuss the resident's specific performance in the case, key learning points, or their progress towards independence, results in high quality feedback. Utilizing a theory-based tool such as the SAP can provide meaningful feedback to neurosurgical residents.

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List of Abbreviations

Abbreviations: Surgical Autonomy Program (SAP), Zone of Proximal Development (ZPD), More Knowledgeable Other (MKO)

CHAPTER 1: INTROUDCTION

Feedback can be a powerful educational tool utilized across multiple clinical training platforms to include the operating room.(1; 3; 14; 28) Formative feedback, a process focusing on improving performance, is an essential component of competency-based medical education, yet its quality is often under reported.(3; 7; 9; 29) While several studies acknowledge the importance of formative feedback with intra-operative teaching, they also show that faculty and residents don't always agree on its value or even if it was given.(4; 6; 10; 16; 18; 21; 22; 25) In an era of work hour restrictions, decreasing case volumes, increasing complexity of care, and rising non-clinical responsibilities, increasing quality feedback is a potential means to improve the effectiveness and efficiency of training surgical residents.(2; 3; 8; 19) So what makes surgical feedback valuable for neurosurgery residents? The goal of this study is to identify factors that influence neurosurgery residents' perception of quality regarding written formative feedback from the operating room using the Surgical Autonomy Program (SAP).(11)

SAP is an intra-operative assessment tool based on Vygotsky's social constructivist theory. The hallmarks of Vygotsky's work is the ability of a learner to achieve more when working with someone that has more experience, also referred to as the More Knowledgeable Other (MKO) , and that challenging the learner promotes growth by identifying their Zone of Proximal Development (ZPD).(24; 26; 30) As defined by Vygotsky, the ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." It is within the ZPD that learning occurs.(24) The identification of a learner's ZPD requires a collaborative approach with their MKO, which takes a different viewpoint regarding the role of the educator.(26)

Within the SAP system, Neurosurgery operative cases have been divided into four parts or zones. For example, a craniotomy for a supratentorial tumor has the following zones: Zone 1= Positioning/Bony Exposure, Zone 2= Craniotomy/Dural Opening, Zone 3 = Tumor Resection, Zone 4= Dural Closure/Flap Placement/Closure (Figure 1).

Figure 1: The predetermined zones of performing a craniotomy for a supratentorial tumor.

Within each zone, the resident is evaluated along a Zwisch-type scale, the TAGS scale, towards progressive independence in performing the case (Figure 2).(5)

Step	Help Level	Primary Direct	Primary Surgeon
T	Teach and Demonstrate	Attending	Attending
A	Advise and Scaffold	Attending	Resident
G	Guide and Monitor	Resident	Resident
S	Solo and Observe	Resident	Resident

Figure 2: The Zwisch-like supervisory TAGS scale of progressive independence in terms of directing the surgery (Primary Direct) and performing the surgery (Primary Surgeon).

Using the TAGS scale, a resident progresses from the first zone of the case to final zone; progressive autonomy as the resident becomes independent in a completing a procedure (Figure 3).

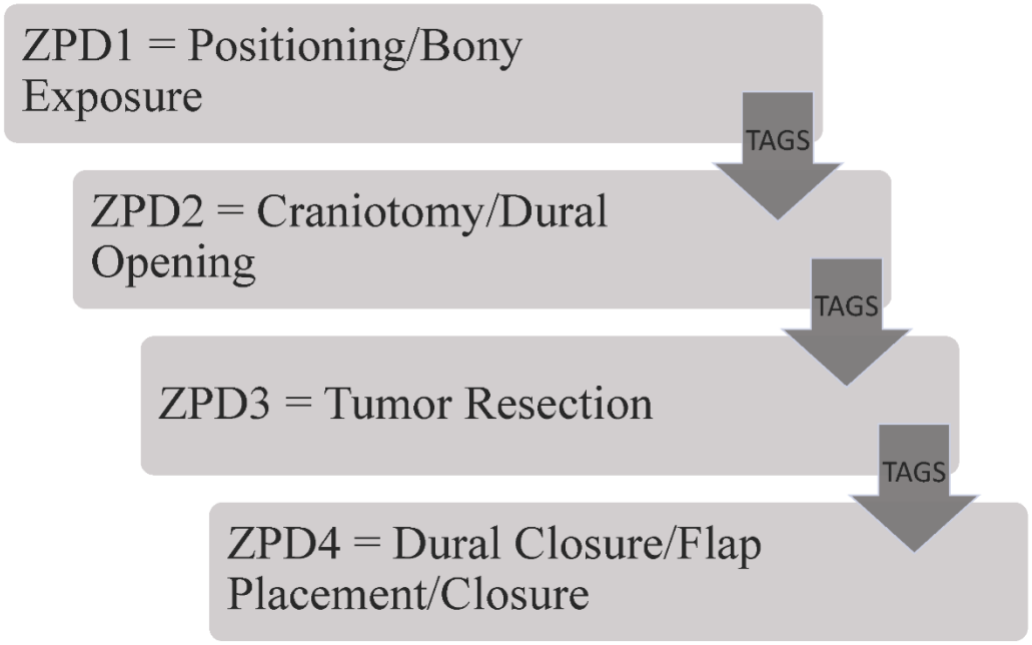

Figure 3: The progression from one zone to the next for a craniotomy for a supratentorial tumor using the ZPD concept coupled with the TAGS scale.

The faculty, the MKO, have access to the resident's cumulative experience with different types of cases, such as craniotomy for a supratentorial tumor. This, along with a pre-operative discussion about the resident's learning goals, is used to determine what zone or part of the case the resident has already shown themselves independent at and what zone they need to work on next; their ZPD. At the end of the case, the resident receives an evaluation on their progress within their ZPD and written feedback from the staff. In their initial evaluation of SAP, Haglund et al demonstrated that the evaluation system was not only feasible, but was able to provide residents with immediate formative feedback and focus on their metacognitive skills.(11)

Purpose and Theoretic Framework:

The purpose of this study is to identify factors that influence neurosurgery residents' perception of quality regarding written formative feedback from the operating room using the Surgical Autonomy Program (SAP).

The theory utilized for this research will be Vygotsky's Zone of Proximal Development (ZPD) within Social Constructivism. In his work Mind in Society, Vygotsky elaborates on 2 key components of his theory: 1. The ability of a learner to achieve more when working with someone that has more experience, also referred to as the More Knowledgeable Other; 2. Challenging the learner promotes growth by identifying their Zone of Proximal Development (ZPD).[30] As defined by Vygotsky, the ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." It is within the ZPD that learning occurs. The identification of a learner's ZPD requires a collaborative approach with their MKO, which takes a different viewpoint regarding the role of the educator. Collaborative learning is a hallmark of Social Constructivism and requires the educator to acknowledge and understand this relationship for it to be successful. In the SAP system, each type of Neurosurgery case is divided into four parts or zones. Data from the resident's previous experience, coupled with a pre-operative discussion about learning goals, allows the faculty, the MKO, and the learner to agree on the part of the case they need to focus the educational effort. This is a collaborative effort to identify the learner's ZPD for that case.

Research Questions:

1. Using the written formative feedback provided to neurosurgical residents with the SAP, what are the common themes that are found within each tier of feedback (Stretching/Affirming, Some Valuable Feedback, and Limited/No Feedback) as classified by the resident?
2. Does use of the ZPD model correspond with Stretching/Affirming feedback?

CHAPTER 2: SUBMITTED MANUSCRIPT

The manuscript entitled “From Their Eyes: What Constitutes Effective Formative Written Feedback for Neurosurgery Residents” was submitted to the Journal of Graduate Medical Education.

Abstract

Background: The characteristics of quality feedback from the neurosurgery resident's perspective are not fully elucidated. The Surgical Autonomy Program (SAP) is an intra-operative assessment tool based on Vygotsky's Zone of Proximal Development (ZPD). SAP facilitates assessment of a resident's operative performance accompanied by written feedback.

Objective: The goal of this study was twofold: to identify themes from the written feedback of SAP operative assessments and to examine if these themes influenced the neurosurgery residents' perception of feedback quality.

Methods: In 2021, SAP data from 2019-2021 at two neurosurgery programs were reviewed. Feedback quality from the SAP was determined by the resident at the time of their assessment. Using a constant comparative technique, the feedback was coded using a thematic analysis. The quality of feedback within each code was analyzed.

Results: There were 2968 SAP entries evaluated. When the ZPD concept was fully used, residents reported high quality feedback 91.4% of the time compared to 58.6% when ZPD was not used ($p<0.001$). Qualitative analysis of the written feedback revealed 5 themes: Non-Specific, Specific General Observations, Key Points, Next Steps, and Independent Practice. Feedback in the Specific General Observations, Key Points, and Independent Practice categories were associated with higher level feedback than leaving the space blank ($p<0.001$) or writing Non-Specific comments ($p<0.001$).

Conclusions: Providing comments that discuss the resident's specific performance in the case, key learning points, or their progress towards independence, results in high quality feedback. Utilizing a theory-based tool such as the SAP can provide meaningful

feedback to neurosurgical residents.

Key Words: Feedback, Zone of Proximal Development, Surgical Autonomy Program, Education, Neurosurgery

Introduction

Feedback is a powerful educational strategy utilized across multiple clinical training platforms, including the operating room.(3; 28) Despite its recognized importance, feedback quality often goes under reported.(3; 29) While several studies acknowledge the role of feedback with intra-operative teaching, they also show that faculty and residents don't always agree on its value or if it was given.(4; 6; 16; 18; 25) Feedback, with the intent to improve performance, is a critical component of competency-based medical education.(15; 23)

The Surgical Autonomy Program (SAP) is an intraoperative assessment tool based on Vygotsky's social constructivist theory known as the Zone of Proximal Development (ZPD).(11) The hallmark of Vygotsky's work is the ability of a learner to achieve more when working with someone that has more experience, also referred to as the More Knowledgeable Other (MKO) and that challenging the learner promotes growth by identifying their ZPD.(26; 30) As defined by Vygotsky, the ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." It is within the ZPD that learning occurs.

In the current literature, the actual composition of feedback in medical education is highly variable and is impacted by multiple factors both from the learner receiving the feedback and the educator delivering the feedback.(13; 17; 27) Without clear evidence of the best practice in the operating room and sometimes without formal faculty development in this area, educators are often challenged to give good feedback. In an era of work hour restrictions, decreasing case volumes, increasing complexity of care, and

rising non-clinical responsibilities, increasing the quality of feedback is a potential means to improve the effectiveness and efficiency of training surgical residents.(2; 3; 8; 19) So what makes feedback from the operating room valuable for neurosurgery residents? The goal of this study was twofold: the first goal was to identify themes from the written feedback of SAP operative assessments; the second goal was to examine if these themes influenced the neurosurgery residents' perception of feedback quality.

Methods

The SAP allows neurosurgical cases to be evaluated in accordance with the ACGME Neurosurgery case log. Each case is broken down into four pre-defined zones

Within each zone, the resident is evaluated along a Zwisch-type scale, the TAGS scale, towards progressive independence (Figure 1).(12)

Step	Help Level	Primary Direct	Primary Surgeon
T	Teach and Demonstrate	Attending	Attending
A	Advise and Scaffold	Attending	Resident
G	Guide and Monitor	Resident	Resident
S	Solo and Observe	Resident	Resident

Figure 1: The Zwisch-like supervisory TAGS scale of progressive independence in terms of directing the surgery (Primary Direct) and performing the surgery (Primary Surgeon).

This TAGS scale guides the faculty on the degree of involvement based on the resident's ability to perform that section of the case, moving across the spectrum of direct to indirect supervision. Using the TAGS scale, a resident progresses from the first zone of the case to the final zone; progressive autonomy as the resident becomes independent in completing a procedure (Figure 2).

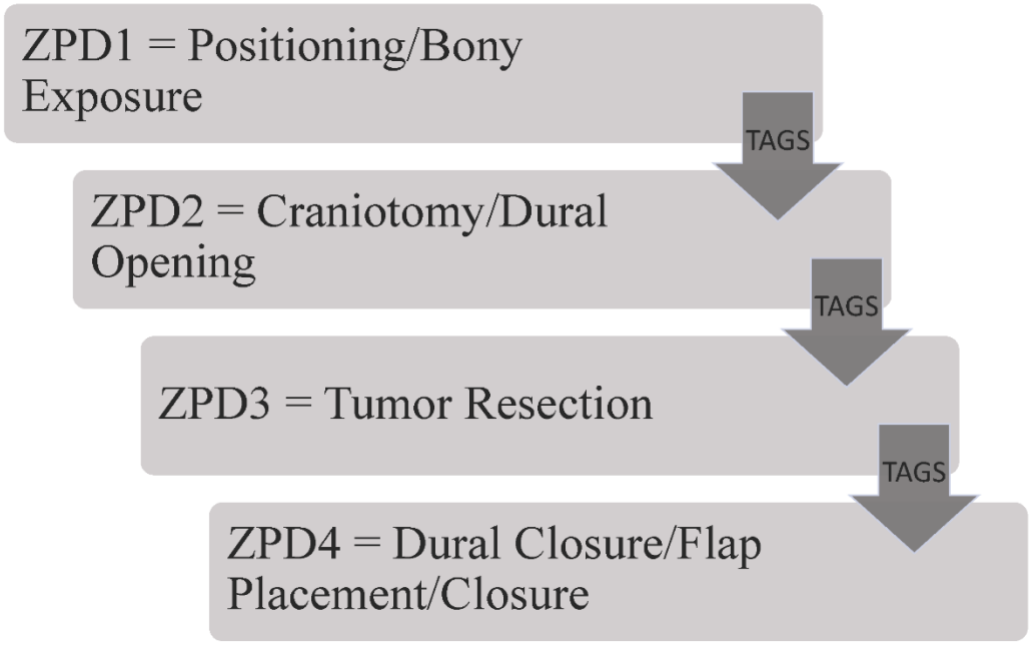

Figure 2: The progression from one zone to the next for a craniotomy for a supratentorial tumor using the ZPD concept coupled with the TAGS scale.

At the conclusion of the case, the attending provides an online assessment with written feedback, rating them along the TAGS scale within their zone. Once the resident receives the written feedback, they categorize that feedback into one of four categories: Significant Feedback both Stretching/Affirming, Some Feedback but Valuable, Some Feedback but Limited, and No Significant Feedback. Additionally, the resident notes whether the attending fully, partially, or did not utilize the ZPD concept during the operative case. The written feedback component of the SAP is the focus of this research.

SAP data from two ACGME accredited neurosurgery training programs, Duke University and the National Capital Consortium (NCC), were utilized for this study. SAP originated at Duke in 2018, while the NCC adopted the evaluation system starting in 2020. Institutional Review Board approval was obtained at both institutions (Duke IRB Pro00102120 and Walter Reed National Military Medical Center IRB considered it a Quality Improvement Process WRNMM-EDO-2021-0709, 935828). No consent was

required. There was no external funding for this research. The lead author, CJN, and senior author, MMH, are the residency program directors at the NCC and Duke University, respectively. The senior author also originated, designed, and first implemented the SAP program at the NCC. The second author (SJD) is also a physician who has expertise in qualitative research. The remaining authors (KEM, NL, RD) were instrumental in data extraction and interpretation.

Data from academic years 2019-2020 and 2020-2021 from both institutions were combined for analysis in 2021. All SAP assessments during this time frame were utilized regardless of case type, PGY level, and institution to maximize the breadth and depth of the resident experience. Individualized resident identifiers are removed in the SAP program data to allow the residents to freely speak their mind and not be concerned about retribution. Using a constant comparative qualitative technique, written SAP feedback from the attending's online assessment following the case was coded into themes by CN and SJD. CN and SJD met frequently to discuss findings and revise codes. We coded for themes based on the utterance (e.g., a given sentence could have more than one theme).

The subsequent analysis had three components. First, the original four feedback groups were combined to form two categories to clarify the analysis by setting up high- and low-quality feedback groupings. The identified feedback themes were then compared against the resident's rating of the quality of feedback to see if there was a relationship between the identified themes and perceived quality. Secondly, the role of using the ZPD process was assessed for its effect on the resident's quality perception. Thirdly, we searched for feedback that contained non-constructive language to determine the effect this language had on the perception of feedback quality. A Chi-square test was

used to evaluate for linear trends in feedback proportions with increasing use of ZPD and to test associations of each evaluation category with feedback quality.

Results:

From academic years 2019-2021, there were 2968 SAP entries between the two institutions, with Duke entering 2607 assessments while the NCC had 361. The average

time to complete both the resident and faculty portion for an individual case was under 60 seconds and for the resident to complete the teaching assessment of the faculty under 30 seconds. The average time between resident completion to faculty completion of the SAP was 7.1 hours.

Table 1 outlines how the feedback was assessed and whether there was full, partial, or no use of the ZPD process. (Table 1)

	No Use of ZPD	Partial Use of ZPD	Full Use of ZPD	Total
Feedback on Evaluation				
Limited to None	147 (32.9%)	126 (28.2%)	174 (38.9%)	447
Valuable to Significant	208 (8.3%)	469 (18.6%)	1844 (73.1%)	2521
Total	355 (12%)	595 (20%)	2018 (68%)	2968

Table 1: The use of ZPD and its relationship to feedback quality. $p<0.001$ for Chi-square test for feedback proportions with increasing use of ZPD.

Qualitative analysis of the written feedback revealed 5 independent themes. Thematic saturation was reached after 750 entries were reviewed. We continued coding all remaining entries for additional thematic content.

The first theme was labeled "Non-Specific" as this feedback offered vague or nonspecific terms that may or may not be related to the operative case. An example of feedback in this theme was:

"Nice job."

Of the 2064 entries with written comments, 691 (33.5%) offered more specific details about the resident's performance during the case. These evaluations were labeled "Specific General Observation." An example of feedback in this theme was*:*

"Excellent technique under the scope, beautiful foraminotomy of L5. Disc was a little difficult to tease out of the space, could get more reps with blunt hook fishing out the disc, but really no concerns about exposure or technique for a disc under the scope."

The theme of "Key Points" was also frequently seen with the written feedback providing general information about the steps involved in the procedure or learning points about the procedure but provided nothing specific about the resident's performance. An example of this was:

"It's key to see the bowels or omentum when passing the peritoneal catheter."

The next theme that was seen was "Next Steps" where the written feedback provided specific items for the resident to work or do for the next case:

"You need to drill out more of the osteophyte with the cutting burr before going to the diamond drill. You also need to make sure that that diamond drill stays parallel and does not dive deep when drilling the trough. We will work on getting your hand in the right position so you can see better in order to perform the removal of the osteophyte with the diamond drill. Good start on zone three more reps."

The final code, labeled "Independent Practice" implied or stated that the resident was ready for independent practice within that type of case:

"*Dr. xxx is independent in this procedure. Impressive"*

Those evaluations with no written feedback (n=904) in the comment section were removed from our thematic analysis. Of the 2968 cases that were coded, there were 3338 individual utterances identified, with 351 cases having more than one code. (Table 2).

Type	Total
Blank	904 (27.1%)
Non-Specific	367 (11%)
General Specific Observation	1001 (30%)
Key Points	631 (18.9%)
Next Steps	284 (8.5%)

Independent	151 (4.5%)
Total	3338

Table 2: The breakdown of the written feedback into codes, to include those when no written feedback was provided (Blank). The written feedback section can contain multiple codes. Out of the 2968 evaluations, 351 had multiple codes resulting in 3338 individual codes identified.

Next, we evaluated codes within each theme along the continuum of resident graded feedback into the two groups: No to Limited Feedback and Valuable to Significant Feedback. (Table 3). Any type of written feedback was significantly associated with a higher level of feedback quality than leaving the space blank ($p \leq 0.001$). Additionally, any written feedback that was more than just non-specific comments were also significantly more likely to be associated with Valuable to Significant feedback ($p<0.001$), except for the theme Next Steps which was not statistically different than Non-Specific feedback ($p=0.17$). Notably, leaving the written comment section blank was considered Valuable to Significant feedback 69.8% of the time, while vague nonspecific terms (Non-Specific) were considered Valuable to Significant in 79% of entries.

Category	**Little to None**	**Valuable to Stretching**	**Totals**	**p vs Blank**	**p vs Non-Specific**
Blank	273 (30.2%)	631 (69.8%)	**904**	--	0.001
Non-Specific	77 (21%)	290 (79%)	**367**	0.001	--
Next Steps	14 (14.1%)	85 (85.9%)	**99**	0.001	0.17
General Specific Observation	44 (4.6%)	647 (93.6%)	**691**	<0.001	<0.001
Key Points	25 (5.6%)	421 (94.4%)	**446**	<0.001	<0.001
Independence	3 (2.7%)	107 (97.3%)	**110**	<0.001	<0.001
Two or More of Next Steps, General Specific Observation, Key Points, and/or Independence	11 (3.1%)	340 (96.9%)	**351**	<0.001	<0.001
Totals	**447**	**2521**	**2968**		

Table 3: Evaluation categories aligned to resident grading of the feedback provided. Each category was compared to those evaluations with no written comments (Blank) and Non-Specific categories. p values are from Chi-square tests for the association of evaluation category with feedback quality category.

When assessing the 3338 individual utterances within the 2698 evaluations, there was no significant difference between the codes General Specific Observation, Key Points, Next Steps, or Independent Practice when compared to each other. Of the 351 evaluations that had multiple feedback themes identified, 253 were associated with Valuable to Significant feedback (72%). This was not significantly better than the feedback found in the 1346 evaluation that contained a single theme, where 907 were rated as Valuable to Significant feedback (67.4%, p=0.11).

Within the Non-Specific group, there were non-constructive comments that showed the attending did not remember the resident's performance. An example of this was:

"Sorry but to be honest, I don't remember the details of this case".

In comparing these "I don't remember you…" comments with the other Non-Specific comments, there was a significant difference in the feedback rating. Of the 367 Non-Specific feedback entries, 27 had these comments that reflected the attending did not recall anything about the resident's performance. In this group, only 44.4% (n=12) had the feedback rated as Valuable to Significant, while in the remainder of the Non-Specific group (n=340), 81.8% (n=278) were rated as Valuable to Significant ($p<0.001$). When comparing these "I don't remember you…" comments to those that were left blank

(n=904), there was a significant decrease in the higher-level feedback where 69.8% (n=631) of the blank comments still garnered this level (p=0.01).

Discussion

Using a qualitative thematic analysis, this study was able to capture the complexity of feedback that is very difficult to fully appreciate with quantitative analysis alone. The actual words that are used in feedback are important and appeared to be noticed by the residents. Notably, our themes aligned with ZPD theory as well as the current literature on feedback.

Comparing themes within written feedback and evaluating them based on the neurosurgery residents' perception of this feedback has not been subject to prior study. For the attending surgeon, the identified themes from this research can serve as a guide on what to include when writing formative feedback based on the resident's performance in the operating room. This study fits with Ramani et al's 2019 call for feedback research to become less about the technique and more focused on the outcome for the learner.(23)

In this study, residents found that written feedback was most appropriate if it contained specific observations about how they performed in the case, a summary of the

learning points from the case, or whether they had reached the point of performing the case independently. While exclusively discussing what to work on next was not statistically different than non-specific comments, the trend was that utterances in this domain are associated with higher quality feedback. A reason that focusing solely on the next step a resident needs to take not reaching statistical significance may be from looking too far past the learner's ZPD and not focusing on where they are currently or the lack of context for taking the next step towards independently performing the case.

It is not surprising that leaving the written feedback section without any comments had the least value to the residents, while generating non-specific comments alone also held less value. Combining more specific themes (Specific General Observations, Key Points, Next Steps, and/or Independent Practice) did not add value over a single theme. While there is the possibility that by hitting multiple performance domains these types of comments offered greater depth for resident reflection, it may also dilute the intended message.

It was notable that nearly 70% of evaluations that were left blank in the written feedback section were still judged to contain valuable feedback. This finding could be from a lack of attention to detail that the residents had when filling out their portion of the form. Even though all data is anonymized and pooled before the attendings see the resident's response, there may be a component of concern about retribution for giving their staff a less than stellar review. Another possibility to not providing written feedback is what McCutheon and Duchemin describe as a concern of negatively affecting the relationship with the resident.(20) Alternatively, this may also represent an evaluation of the system of assessment within the SAP, as the residents still received their

written TAGS scale that, when coupled with verbal feedback during the case, may result in the sense of satisfaction with the feedback received. In fact, 88% of the residents noted there was at least a partial use of ZPD in their feedback process and those evaluations that used ZPD were statistically more likely to contain high quality feedback. In Haglund et al's initial paper on the SAP, there was a focus on the metacognitive process involved with the resident reflecting on their assessment, whether through the TAGS scale, the written comments, verbal feedback, or a combination.(12) The process of a resident contemplating and analyzing their performance is a powerful improvement tool that may only be indirectly seen in this study through the quality rating of the blank comment section.

Another notable finding comes from the "I don't remember you" comments that were seen. These clearly represented the minority, seen in only 27 out of 2968 evaluations reviewed. However, this small group of comments performed significantly worse than all other themes; even those that left the written comment section blank. We believe this may reflects a breakdown in the social contract between the attending and the learner. Failing to remember a resident's learning experience offers little chance of providing growth promoting feedback.

How to give feedback has been a topic of interest within the medical community for decades. In 1983, Ende wrote about "Vanishing Feedback" and the consequences regarding the absence of feedback in medical education. Specific to this study, he notes that feedback should be undertaken with the teacher and trainee working as allies with common goals, well-timed and expected, based on first-hand data, limited to behaviors that are remediable, and phrased in descriptive nonevaluative language.(7) This echoes

the underpinnings of Vygotsky's theory where the MKO works with the learner to identify their ZPD and together raise the learner's knowledge and/or technical ability into the next zone of learning; the learner and the MKO are partners. Or to put it differently, the neurosurgical resident and attendings are allies where the attending uses direct observation in the operating room to provide specific guidance on how to improve. This study also showed the timeliness of formative feedback, with a median time of 2.9 hours until both the resident and attending had completed the SAP. As Williams et al pointed out in their study on timeliness of providing operative assessments, the earlier the assessment is provided, the more specifics about the resident's performance it contains. After 3 days, an evaluation contains little value.(31)

There are several limitations in this study. The first is that only written feedback and not the verbal feedback that occurred during the case was evaluated. Additionally, we could not ask follow-up questions to the faculty on what they meant in their comments or to the residents on exactly what was in the comment that seemed valuable. Given the multi-center nature with attendings and residents across a spectrum of experience, there was no common frame of reference for feedback that was given prior to initiating SAP or with this study. While this study does provide a clearer picture on what type of feedback residents find valuable, it also sets the stage for additional in-depth analysis of why residents felt some types of feedback are more valuable than others. Such an analysis would likely yield a better understanding of a residents' perception of feedback.

Conclusions

This study evaluated the resident's perception of written feedback from the operating room through the SAP system at two academic institutions. There were several key findings that influence how written feedback is perceived by neurosurgery residents. First and foremost, providing written comments that discuss the resident's specific performance in the case, key learning points or their trajectory towards independence results in higher quality feedback than leaving the written comment space blank or writing something non-specific about the case. Secondly, do not focus the written feedback solely on the next steps that they need to develop as this may be looking past the resident's current ZPD. Third, if a program uses the SAP system, higher quality feedback results from using the ZPD process. And finally, if an attending does not remember the details of a resident's performance, it is better not to fill out an evaluation at all. In summary, our study demonstrates that utilizing a theory-based tool such as the SAP can result in high quality, more meaningful feedback for neurosurgical residents.

CHAPTER 3: DISCUSSION

My initial interest in the field of feedback research came after reading the paper by Gulbas et al where they used a group of medical students to review written feedback and classify this feedback into various categories of quality.(10) This immediately struck me as brilliant. The students, being the end users of the feedback, informing those who give the feedback what is high or low quality. Furthermore, it speaks to the work by Ramani et al's that encourages the field of feedback research to become less about the technique and more focused on the outcome for the learner.(23) My criticism of Gulbas et al's work was that the students who reviewed the feedback were not the original students who received that feedback. To me, this misses the individualized context in which the feedback was given. How did that learner, in that situation, determine the quality of the written feedback that was given? When I started to use the SAP, I immediately thought of Gulbas et al's paper and saw an opportunity to resolve my own criticism of their work. Of course, this is easier said than done.

Some of the results of this study were not surprising. Leaving the comment section blank or writing non-specific comments were not as valuable as writing something specific about the learner. This has been previously demonstrated in the feedback literature.(10) Analogous to this, using language that is detailed and specific to the event being described, in this case the resident's performance in surgery, is a common guideline when providing feedback.(7) So the fact that the residents rated the relative

value of these themes as they did adds nothing new, but it does reinforce these points. It was the more nuanced results that I found most interesting.

Feedback focused on what to work on next was not seen as valuable to neurosurgery residents. What I thought was a common component of feedback was not statistically different than non-specific feedback and only showed up in 8.5 % (n=284) of the feedback in this study. Instead, neurosurgery residents valued independence; the description that signifies they could do this procedure on their own compared to non-specific comments. Interestingly, the theme of independence showed up less frequently being seen in 4.5% (n=151) of feedback. While these themes were the least frequently used themes in this study and had no statistical difference between them, it raises several questions in my mind. Why didn't the residents see values in the steps to autonomy if autonomy is valued? Why didn't neurosurgery attendings utilizing these categories more frequently in this study? Is this specific to neurosurgery or at least other surgical fields? Would this apply to feedback in a clinical setting instead of an operative setting?

Equally as interesting was the theme of Key Points, seen in 18.9% (n=631) of feedback and was the third most identified theme in the study. This theme highlighted learning points from the case, but really had nothing to do with the resident's performance. Yet this was commonly used and seen as valuable. When writing feedback, why would the attending neurosurgeon focus on summarizing the steps in a procedure over other aspects of the resident's performance? Was this just an easy way to write down something of educational value or does this represent quality feedback?

The final aspect of this study that I find interesting is why such a large percentage of blank or non-specific comments still garnered high quality feedback designation from the learners. I would like to believe that this speaks to the SAP system and the teaching/learning experience of that case and sets the baseline for all written evaluations to be judged against. But this does raise the question of how much can we trust the resident evaluation of the feedback in this system. Regardless of the rated value, it is hard to look at this study and see that when given the opportunity to write down feedback, attending neurosurgeons in this study didn't take advantage of this opportunity more than 38% of the time. Instead, they either don't write anything (27.1%, n=904) or wrote something non-specific (11%, n=367). This speaks to the need for faculty development in this area.

As this discussion has pointed out, this study has several limitations. As a retrospective study, we lack context for these comments or the lack therefore. We are unable to capture the verbal feedback during the case or the actual teaching that occurred that may influence a resident's perception of the case. Since this study was performed between two institutions, we start to mix experiences with how faculty are trained in feedback, how experienced faculty are in giving feedback, and the culture in the different programs on receiving feedback.

Future studies utilizing the SAP feedback system should focus on the context of feedback to gain a greater insight into what residents find valuable. Focus groups or interviews of residents to follow up on the questions raised above can be performed. Since the SAP is utilized across other surgical disciplines, it would be interesting to see how feedback themes compare across surgical specialties. And finally, using these

results to develop specific neurosurgery faculty development on writing intraoperative feedback can be performed and utilized as frame of reference training with follow on studies comparing pre- and post-intervention changes in feedback.

SOCIETAL & SCIENTIFIC RELEVANCE

Graduate medical education is at a crossroads between its desire to be competency based

and its actuality of being a time-based system. The result is a mixed process that is built on tradition, medical education theory, and gestalt. Recently in Neurosurgery, the ACGME required twice as many cases to be performed to meet the minimum standards for graduation. With this mandate going into effect for graduates starting in 2021, this was explained to the program directors as furthering our contractual obligation to society; that we are ensuring that our graduates are prepared for independent practice. But the real issue is not more cases or more time in training, but the development of competency. The assessment of competency can be complex, but it does involve the use of direct observation that provides formative feedback for the learner to understand what they are doing well and what they need to improve upon. Understanding how to improve the process of feedback is critical to furthering surgical education. This is especially true in Neurosurgery. This research aims to understand what contributes to valuable feedback from the perspective of the resident.

Military Relevance

Military graduate medical education is once again experiencing a crisis as it seeks to

define itself in a world without a two-front war, besieged by competition from various hospital systems and insurance plans, a disconnection between veteran and active-duty care, and determining how to pay for a promise made of lifelong health care. If we expect to not just survive but to excel in this environment, we must graduate outstanding medical providers that are worldwide deployable, independent practitioners that are ready to go on day one. Maximizing our training opportunities is fundamental to this goal. This requires educators to take advantage of every teaching opportunity. Understanding how neurosurgical residents perceive feedback and what contributes to this perception is an important component of this process. Better feedback can lead to the accelerated attainment of competency and proficiency by identifying and communicating the next steps for growth and how to achieve them. Better-trained neurosurgeons coming out of residency means a higher level of readiness for our combatant commanders.

Conclusion:

In reflecting on my original research questions, the results of this study have changed the way that I think about and write my intraoperative feedback. I now focus on specifics, highlight the key take aways from the case, and I reference where my residents are regarding their ability to perform the surgery independently. To the point made by Ramani et al, I have used this research to focus my feedback comments for the benefit of my residents.(23) But I do not think that this is enough. Introducing and using a structured evaluation and feedback system that is based on theory, such as the SAP, does improve the quality of feedback. This starts the process of changing the culture of a program to one where feedback is expected and consistently given. To complete the transformation, there is a need for faculty development with a specific emphasis on frame of reference training that is shared between residents and faculty. With such a shared mental model of what intra-operative feedback should look like, we can improve our resident training experience. This thesis is only a starting point for neurosurgery.

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